Appendix B – DECISION CRITERIA CHECKLIST

When North Cascades NPS Complex locates a fire within its boundaries the following two questions are asked in order to determine a fire management response:

1. Is the fire human caused?
2. Is the fire in a Suppression Response Zone?

If there is a "yes" response to either of these questions a suppression response is initiated. If there is a "no" response to both questions, then the fire is evaluated for a wildland fire use fire by initiating the Decision Criteria Checklist, which is completed for stage I of the Wildland Fire Implementation Plan (WFIP). All fires that are not human caused and are not in a suppression zone must go through this checklist prior to taking any suppression action. The checklist is completed within two hours of the fire report, and is re-evaluated every 1-5 days. The following is a copy of the checklist:

Decision Element	***YES***	***NO***
Is there a threat to life, property or resources that cannot be mitigated?		
Are potential effects on cultural and natural resources outside the range of acceptable effects?		
Are risk assessment results unacceptable to the Superintendent?		
Is there other proximate fire activity that limits or precludes successful management of this fire?		
Are there other Agency Administrator issues that preclude wildland fire use?		

The Decision Criteria Checklist is a process to assess whether or not the situation warrants continued wildland fire use implementation. A "yes" response to any element on the checklist indicates that the appropriate management response should be suppression-oriented.

Recommended Response Action (check appropriate box)	**NO-GO** (Initial attack/suppression action)	
	GO (Candidate fire as WFU)	

Line Officer(s) Approval Title Date

Appendix C – PEER REVIEW REPORT: Stehekin Valley Forest Fuel Reduction/Firewood Management Plan

In April of 2000, a review panel was invited to comment on the treatment progress of the 1995 Stehekin Valley Forest Fuel Reduction/Firewood Management Plan. The plan was initiated to reduce the overabundance of vegetation at the south end of the park in the Stehekin Valley. This document summarizes the primary findings the panel members discussed with the NPS staff during the three-day review.

Background
In 1995, a plan was developed to combat the overabundance of fire intolerant vegetation in the Stehekin Valley. The plan called for the removal of this vegetation through a combination of prescribed fire and thinning techniques. This process would ultimately replicate natural disturbance mechanisms that maintained fire-tolerant and healthy ponderosa pine and Douglas fir dominated vegetation prior to fire suppression activities of the 1900's.

The Forest Fuel Reduction and Firewood Management Plan is specific to desired future conditions for vegetation in each of 9 treatment areas. This includes number of trees by species and their size classes, as well as overstory cover percentages. It is anticipated that when the desired future condition is met, a burning schedule will be put in place to maintain that desired condition (or a similar condition).

Seven hundred and ninety acres of forest on the Stehekin Valley floor were targeted for treatment. The treatment goals were to:

1. Improve wildland fire protection in the Stehekin Valley through hazard fuel reduction in strategic areas (which came to be known as Forest Fuel Reduction Areas) and around structures.

2. Manage for a late-successional stage Douglas fir/ponderosa pine forest and increase the proportion of ponderosa pine in selected areas to be consistent with this forest stage (Current abundance of ponderosa pine is less than 1% of historic figures).

3. Protect other natural and cultural resources (rare, threatened and endangered species, historic structures, historic landscapes and historic districts).

Finally, the treatments were to be monitored and evaluated using the standard National Park Service prescribed fire monitoring protocol.

Since 1995, 287 acres have been under-burned, 165 acres of trees less than 6" in diameter have been thinned and 37 fire effects monitoring plots have been established. Firewood offerings to the public have been adequate at meeting the public's expectation for heating needs.
Review process
The plan requires a five-year review of the treatments by a committee of peers. Committee members were chosen for their expertise in the management of public lands, and for their research and academia background.

Bruce Freet*	Chief of Resource Management	North Cascades NP, NPS
Gina Rochefort*	Science Advisor	North Cascades NP, NPS
Matt Rollins*	Fire Ecologist	Rocky Mountain Research Station, USFS
Jim Hadfield*	Forest Pathologist	Wenatchee Forest Science lab, USFS
Paul Hessburg*	Research Plant Pathologist	Wenatchee Forest Science lab, USFS
Karen Kopper*	Lead Fire Effects Monitor	North Cascades NP, NPS
Tod Johnson*	Fire Management Officer	North Cascades NP, NPS
Andris Vezis	Fire Crew Leader	North Cascades NP, NPS
Paul Reeburg	Fire Effects Specialist	Pacific West Region, NPS

Marsh Haskins*	Fire Management Officer	Chelan Ranger District, USFS
Scott Stonum	Resource Manager	North Cascades NP, NPS
Trygve Culp	Siliviculturist	Okanogan National Forest
Ed Pontbriand	Stehekin District Ranger	North Cascades NP, NPS

** Revised comments following initial field review*

The committee was to review the progress of the plan and its outcome. Evaluating persons were to consider:

1. How well the plan meets goals and objectives,

2. How well the plan is being carried out on the ground,

3. How well the activities are captured by the monitoring method,

4. Whether the local public is accepting of the plan, and,

5. Whether new science needs to be considered in the management of mixed-conifer ecosystems.

On April 10, 2000, the review committee met in Stehekin to review the plan over a three-day period. Treatment areas were assessed with over 120 recommendations recorded. Additional comments were recorded at evening debriefing sessions. The hosting agency remained in Stehekin to finish recording recommendations and ideas.

The National Park Service hosted a public meeting at the Golden West Lodge on April 11, 2000. Approximately 20 people from the Stehekin community attended to listen to recommendations of the peer review committee. Public comment was put into record. Those comments mirrored many of the comments and recommendations made by the review committee. All of the comments made by the attending public focus upon wanting more fire protection sooner, suggesting the forest thinning and burning treatments were looked upon favorably by those attending and commenting.

Once all comments were tabulated, they were resubmitted to committee members for review. Some team members revised, updated, corrected and prioritized their comments. The prioritization of recommendations was based on how the program activities could best be adjusted to meet the intent of the plan. Those recommendations are the body of this document. North Cascades National Park staff will consider the comments and recommendations when updating the plan and treatments. Other interested parties will have an opportunity to comment on the recommendations prior to adoption of any changes.

It is intended that any agency-adopted recommendations would amend the current management plan.

The list of 120 recommendations sent out for review are found in Appendix A of the Peer Review Report. This list includes the comments made by the public attending the meeting on the 11th.

Considerable comment was made about the use of prescribed fire in the spring season. This spurred a follow-up investigation of mortality on random transects in the Company Creek and Coon Run burn areas, conducted by Jim Hadfield later in May. His findings are located in Appendix B of the Peer Review Report.

Primary Recommendations: The Stehekin Forest Fuel Reduction and Firewood Management Plan

Comment 1

The Park Service has few options to dispose of its excess debris. Currently, the Park service relies on firewood gatherers to reduce the amount of accumulated fiber, which amounts to less than 100 cords collected per year. This consumption dictates the rate of progress in meeting the goals set forth in the "Forest Fuel Reduction and Firewood Management Plan". At this rate, meeting the goals of the plan could take 35 to 50 years. This is not soon enough.

Plan language pertaining to comment

Page 25. *"As the plan is implemented, practical experience will undoubtedly provide insights for improving the operations and administration. Two major aspects will probably deserve further consideration: (1) Does the supply of surplus wood exceed the demand to the extent that it is hampering progress toward greater fire protection?*"

Discussion

Although it is never directly stated in the plan, one of the reasons that the thinning operations were stretched out so long, was to provide a living supply of firewood to the community for the next 35 years. This point needs to be considered in context with the discussion and recommendations below.

The natural fire return interval for this vegetation type is less than 35 years. No large fires have occurred on the valley bottom for over 100 years, which means excess debris has not been cleansed, and natural conifer control has not existed since the late 1800's. The potential for high-intensity, fast-moving fire and the current poor forest health is why the plan was developed in 1995. It seems likely that, given current rate of progress, a natural or human-caused fire will threaten the lives of visitors, residents and residences and affect ecosystem dynamics prior to meeting the plan's desired future condition.

Current thinning practices take an incremental approach to meeting the plan's desired future condition. The first thinning entry targets 6 inch DBH and smaller conifers only, regardless of canopy closure or spacing of the other size classes. The slash created from this thinning is left on the ground for firewood utilization, and nutrient absorption up to three years. The ending slash bed is then under burned to reduce the small diameter fire-carrying debris. The next thinning entry removes conifers 8 inch DBH and smaller, and the slash is under burned following firewood utilization. This incremental approach is duplicated until the desired condition, as described in the plan, is met.

Under this treatment regime, the full ecological and fire protection benefits of thinning and prescribed fire may not be achieved for decades. The effects of repeatedly disturbing the same acre with multiple treatments are not fully understood. However, one could surmise that chronic disturbance increases the risk for noxious weed introduction and increased smoke exposure to humans, and increased risk of prescribed fire escape, resulting from multiple prescribed fire events. Would a one time thinning entry, followed by prescribed fire, reach desired restoration goals quicker, cost less money and reduce ecological and social risks?

Recommendation

The review team strongly encourages the Park Service to attempt to reach its desired future condition sooner than planned. Look for more alternatives to the wood fiber utilization problem, such as co-generating power, exporting of firewood, donating wood fiber to charity, etc. in order to speed up its treatment progress. They also believe that removing the excess debris (from the forest) and stacking it somewhere to be utilized, chipped or ultimately burned is a better solution than allowing the excess conifers to continue contributing to poor forest health and high fire hazard.

Comment 2

Fifty-five percent of the treatment areas were designated as "prescribed burn only" units. Prescribed fire treatments alone are inadequate for meeting the desired future condition in those areas. The fuel beds in the majority of these "prescribed burn only" stands are incapable of producing fire intensities necessary to achieve the amount of conifer mortality required to meet the desired future condition set forth in the plan, within acceptable fire behavior parameters.

Plan language pertaining to comment

Page 19. *"Prescribed fire is the primary tool used for long-term fuel management in the forest fuel reduction areas. However, initial manual thinning is necessary to remove a portion of the younger age classes of predominately Douglas fir that have survived under a fire suppression policy and are now too large for low intensity prescribed fire to effectively thin… Manual thinning is*

necessary to reduce the risk of large-scale forest-stand replacing wildfire. Reducing the overall fuel loads (forest canopy, ladder fuels, and surface fuels) to a safer level for prescribed fire and fire suppression and encouraging ponderosa pine in mixed conifer and Douglas fir /ponderosa pine stands is recommended."

Page 1. *"The Hazard Fuel Reduction Plan, used from 1990 to 1994, initiated a prescribed burning program in the Stehekin Valley. The four prescribed burns completed during this period reduced surface fuels in 109 acres of coniferous forest on the valley floor but did little to reduce the ladder fuels or the dense canopy that contributes to the spread of wildfire through the tree crowns."*

Discussion

The plan designates 355 acres as "thin and burn" and 435 acres of "prescribed burn only". The intent was to test the effectiveness of each of the treatment types (presumably to see if the desired future condition could be met). Both of these treatment types exist within each Forest Fuel Reduction Area, with the exception of Weaver, which is a "prescribed burn only" treatment area.

The two treatment types segment the Forest Fuel Reduction Areas requiring common boundaries within the same plant association types. Instead of 6 units with similar treatment types, 26 subunits exist, segmenting the FFRAs. During prescribed fire treatments, hand line and hoselays are required to keep fire out of adjacent treatment types because prescribed fire prescription windows are different for a thinning-created slash bed then they are for a "natural" fuel bed.

These two fuel bed types require burning to occur under differing conditions, creating a scheduling problem with the thinners, prescribed fire specialists and wildlife specialists concerned with exposure of personnel and smoke to rare, sensitive and endangered species. The fragmented nature of the altering treatment types reduces the ability of prescribed fire managers to take advantage of atmospheric windows capable of venting large volumes of smoke out of the Stehekin Valley. Because similarly treated adjacent acres are not available for prescribed fire treatment due to treatment type. All of these scheduling problems ultimately slow progress towards reaching the desired future condition.

The compact Douglas fir needle which replaced the looser ponderosa pine needle layer as primary carrier of fire results in burning that is very spotty, making achievement of consumption and mortality targets very difficult or impossible. Post-burn investigation of the "prescribed fire only" units show similar success at meeting desired fuel loading and tree mortality as the units that were burned prior to the implementation of the 1995 plan.

Very little ground fuel exists following the prescribed burning. In those areas burned 3 years ago, little recruitment of dead material has occurred leading one to believe there would not be enough fuel necessary to meet mortality objectives with prescribed fire on it's scheduled reentry.

Goals and objectives for the Forest Fuel Reduction Areas require a reduction in canopy through the reduction in stems. This accomplishes two things; it reduces the probability of high intensity crown fire while providing enough sunlight to the forest floor for regeneration of ponderosa pine. The inability of the "prescribed burn only" units to meet these two objectives may likely result in not meeting the plan's overall and primary objectives of fire risk reduction and reestablishing ponderosa pine on over 55% of the planned acres.

Recommendation

Where feasible, convert "prescribed burn only" treatments to "thin and burn." This will speed up scheduling, remove cumbersome sideboards to treating large areas, and ultimately increase the speed and probability of success in meeting forest restoration and fire protection objectives.

Comment 3

The Forest Fuel Reduction and Firewood Plan identified treatment needs on the Stehekin Valley bottom that would prevent fire from moving down valley from a fire originating on the valley floor. Given that most

of the ignitions in the valley are lightning caused and occur on the mid- to upper-slopes of the valley, the park should consider expanding its scope of treatment to include the mixed conifer zones outside of the current Forest Fuel Reduction Areas.

Plan language pertaining to comment

Page 11. *"The forest fuel reduction areas are one line of defense for wildfires moving up or down the Stehekin Valley or entering the valley from side canyons like Boulder Creek."*

Discussion

The North Cascades National Park and surrounding federal lands have a long history of large, landscape-size natural fires that resulted when prolonged drought combined with high winds. In 1994, fires including the Tyee Complex on the Wenatchee National Forest and the Boulder Fire above the community of Stehekin, were both examples of this type of fire spread. In addition, North Cascade fire history mapping shows fire events exceeding 10,000 acres. This is the type of fire that is of most concern to fire managers because fire behavior tends to be extreme and uncontrollable.

The Forest Fuel Reduction and Firewood Management Plan does a good job of identifying firebreaks that would work well at protecting homes and provide good anchor points for firefighters during most fire events. Namely, fire during average burning conditions that starts on the Stehekin Valley floor. However, recent studies of large fire movement indicate 50% of all large fires starting in one watershed will impact adjacent watersheds. These are the types of fires that will most threaten the Stehekin community and the longevity of mixed conifer plant associations. Increasing opportunity for fire managers to control and use fire during large fire events will increase the probability of successfully defending the Stehekin Valley's cultural and ecological resources.

Reducing the threat of fire moving into the valley from higher elevation ignitions should be a consideration in any project planning in areas like Stehekin. There are two primary reasons for this:

1. This will ultimately provide for greater fire protection in the Stehekin Valley by providing fire suppression opportunities for managers before fire enters the valley from higher elevations.

2. Treating specific areas with prescribed fire would increase the likelihood that natural ignitions can play their natural role in the Steven Mather Wilderness with little or no suppression action and with fewer ecological and social impacts.

Recommendation

Explore the uses of prescribed fire outside of the current planned area to meet forest restoration goals, reduce threat of large scale wildfire events threatening the Stehekin Valley, and to increase the opportunity for Wildland Fire Use for Resource Benefits (WFURB) fire to renew its role in higher elevation forests.

Comment 4

The fire effects monitoring design needs to be better integrated into the treatment plan so that planners and implementers can quickly assess the effects of the treatments and make critical changes if necessary in a timely manner.

The objectives in the monitoring plan need to be coordinated with the prescribed fire and thinning objectives to complete the loop necessary for the feedback of appropriate information.

Plan Language pertaining to comment

Page 73. *Monitoring. "Initially at least 10 plots will be set up in each monitoring type. An analysis of these initial plots will indicate whether additional plots are needed for statistical significance, or whether the treatment areas should be subdivided into separate monitoring types."*

The discussion in this section of the document goes on to recognize that not all variables can be measured to statistically valid levels, rather that some variables will be used for trend analysis and are considered "red flags" to indicate change.

" In the Stehekin monitoring program the downed woody fuel loading and the proportion of tree species will be measured to statistically valid levels if possible."

Discussion
A monitoring program should assess the results of treatments in a timely, efficient manner, so that positive and negative trends are easily recognized by the implementation, monitoring and planning teams. The Forest Fuel Reduction Plan states clearly the desired future condition for each Forest Fuel Reduction Area. The monitoring design should provide post-treatment information that will allow planners to assess how the treated condition measures up against the desired future condition. When the desired future condition is met, the restoration phase is over and the maintenance phase, using periodic light intensity prescribed burns, begins. The current monitoring design does not, with reasonable accuracy, provide the necessary information.

Rather than attempting to assess the progress of treatments in each Forest Fuel Reduction Area, the current monitoring design attempts to capture the effects of the differing treatments, regardless of Forest Fuel Reduction Area. In essence, it is set up to test the differences between the “thin and burn” treatment areas and “prescribed burn only” treatment areas. The standard NPS monitoring protocol employed in Stehekin is not designed for this type of experimentation, nor can it effectively provide accurate information post-treatment to satisfy the curiosity of the treatment implementation team. Converting “prescribed burn only” treatment areas to “thin and burn” areas will increase the statistical validity of the monitoring program by reducing the number of treatment variables, thus providing more data for analysis.

Other comments suggest plot locations are not representative of the expected potential natural vegetation of the majority of the mesic upland treatment areas. These plot issues need to be resolved because they negatively skew data away from the desired condition when clearly the desired condition cannot be achieved at the plot location. Perhaps the plots in question belong in a separate monitoring type.

Turnover in fire effects personnel has left behind inconsistent data. Some of the incorrect data was the result of plants that were improperly keyed-out, along with miscalculations of mortality, tree heights, DBH etc. Ultimately the accuracy of those data will need to be resolved before inclusion into the data set.

Recommendations
-Reassess the monitoring plan to determine what monitoring outcomes would best test the plan’s intent. Coordinate monitoring objectives with thinning and prescribed fire objectives, to effectively provide feedback on successes and failures of each treatment.
-Revisit the use of control plots and consider converting them to plots that will be treated. This will add more treatment effects data to the treatment database boosting its statistical validity.
- Clean up old data and correct where possible. Questionable data should not be used in analysis.
- Consider splitting monitoring types by vegetation community type. Three vegetation types would result.
- Provide a career ladder in Fire Effects Monitoring by providing an assistant fire effects crew leader that is a subject to furlough position. This will provide consistency from year to year as employees develop and move into other positions.
- Supplement the current plots with Brown's transects to provide statistically valid data on fuel loading. Include tree species, mortality and crown closure to the data collected on those transects.

Comment 5
The Park Service should concentrate on providing safe escape routes and safety zones for the Stehekin Valley.

Plan Language
Page 24. *“In zones treated only with prescribed fire an average of 6-8 snags per acre will be allowed to remain standing, but snags within 200 feet of primary roads or the perimeter of the forest fuel reduction*

areas may be removed for increased fire protection and firefighter safety… In the manually thinned zones all snags will be removed. ."

Discussion

One of the highest priorities in the Forest Fuel Reduction and Firewood Management Plan is the safety of human life. The planned fuel reduction treatments will go a long way in reducing this risk. However, there is considerable need to provide visiting public and residents safe avenues of egress and reliable safety zones. Three safety zones have been defined by park staff: the field at Buckner Orchard, the airstrip, and, the field at the Courtney Ranch. After some hazard abatement work and follow up maintenance, all of these zones would be large enough to support several hundred people.

However, current roadside hazards prevent the existence of true safety zones. The absence of fire as a cleansing tool has lead to an overabundance of coarse woody debris and vegetation along the roads used for fire suppression and egress to safety zones. Of primary concern is the number of snags that lean toward these roads. These snags could fall onto the roads, blocking escape routes. The overabundance of live and dead burnable vegetation along the roadsides could also impede progress. In addition, safety-conscious firefighters will turn down assignments if, in their judgment, they do not have safe access to a safety zone. The safety concerns mentioned above could prevent fire suppression personnel from attacking a fire. Not providing safe egress to safety zones will ultimately derail the plan's number one priority, which is the protection of human life. Until roadside hazards are mitigated, designated safety zones can not exist.

The review team recognizes the necessary role of coarse woody debris in these forest ecosystems. It is important for resource managers to enter into a planning process balancing needs for public safety with the requirements for wildlife habitat.

Recommendation

Develop projects that will reduce the amount of roadside vegetation, dead fuels and dangerous snags along the Stehekin Valley road system. Once the desired outcome has been achieved, develop an evacuation plan and information methods to be sure residents, employees and park visitors are aware of how to survive a large fire in the valley.

Appendix D – APPROVED DIP LAKES

The following is a list of lakes within the Complex that have been identified as eligible sources for dipping into for helicopter bucket drops during fire suppression. Selection criteria were based on minimum depth and surface area measurements; lakes that are less than or equal to 10 acres in size must be greater than 23 feet deep (maximum depth), and lakes that are greater than 10 acres in size must be greater than 16 feet deep (maximum depth).

Water Code	Water Name	Acres	Maximum Depth (ft)
MP-09-01	AZURE	91.6	344.5
MC-12-01	BEAR	25.7	151.9
M-08-01	BERDEEN	126.7	215.0
LS-07-01	BLUM (LOWER/WEST, N0. 4)	6.4	25.9
MC-02-01	BLUM (VISTA/NORTHWEST, NO. 1)	2.5	35.0
DD-04-01	BOUCK	10.8	63.1
MM-10-01	COON	11.3	17.2
MC-06-01	COPPER	12.7	67.2
CP-01-01	DOUBTFUL	30.2	62.4
M-04-01	GREEN	80.0	153.0
GM-02-01	GREEN VIEW	41.7	155.2
SB-01-01	HIDDEN	61.7	258.2
HM-02-01	HOZOMEEN	97.5	62.3
LS-06-01	IPSOOT	8.9	50.8
MR-05-01	KETTLING	9.9	23.0
FP-04-01	KLAWATTI	76.4	108.3
MR-10-01	MCALESTER	13.2	23.0
MC-16-01	MIDDLE (UPPER)	4.5	25.9
M-23-01	MONOGRAM	27.9	122.1
FP-07-01	MORAINE	83.3	108.3
PM-01-01	NO NAME	7.5	31.2
MS-04-01	OUZEL	6.3	32.2
MSH-03-01	PRICE	53.2	86.0
MR-14-01	RAINBOW	15.5	107.6
MC-11-01	REDOUBT	18.4	45.9
HM-03-01	RIDLEY	10.9	35.1
MA-03-01	SILENT (LOWER)	3.1	31.5
MA-02-01	SILENT (UPPER)	3.7	32.8
MS-01-01	SILVER	162.3	521.7
PM-03-01	SKYMO	10.8	20.0
PM-12-01	SOURDOUGH	27.6	107.0
EP-09-02	STOUT	25.2	175.5
MC-17-01	TAPTO (UPPER)	10.2	43.0
M-20-01	THORNTON (LOWER)	55.1	108.3
M-19-01	THORNTON (MIDDLE)	11.9	78.7
RD-02-01	THUNDER	6.8	27.1
GM-01-01	TRAPPER	147.2	160.8
MR-11-01	UNNAMED	2.9	27.5
MP-02-01	UNNAMED (FIRN)	5.7	37.7
EP-14-01	UNNAMED (HIDDEN LK TARN)	4.9	42.7
MC-07-01	UNNAMED (KWAHNESUM)	16.7	104.3

Water Code	Water Name	Acres	Maximum Depth (ft)
M-07-01	UNNAMED (LOWER BERDEEN)	7.5	36.1
M-05-01	UNNAMED (NERT)	3.6	27.7
MR-01-01	UNNAMED (STILETTO)	9.9	84.0
ML-02-01	UNNAMED (SWEET PEA)	10.3	92.1
ML-03-01	UNNAMED (TORMENT)	3.6	45.0
DD-05-01	UNNAMED (UPPER BOUCK)	5.5	29.0
MR-15-01	UNNAMED (UPPER DEE DEE)	12.2	89.2
MR-13-02	UNNAMED (UPPER RAINBOW, SOUTH)	3.6	24.1
MM-11-01	UNNAMED (UPPER RAINBOW, WEST)	3.5	27.6
EP-06-01	UNNAMED (UPPER WILCOX/LILLIE)	10.5	65.9
ML-04-01	UNNAMED (VULCAN)	8.2	25.2
MM-06-01	WADDELL (LOWER/SANDALEE)	10.1	39.0
MC-27-01	WILD	12.7	28.9
HM-04-01	WILLOW	16.9	24.6

Appendix E – FEDERAL AND STATE LISTED FISH AND WILDLIFE

E=endangered, T=threatened, C=candidate species

Common Name	Scientific Name	Status (Jan. 2005)	
		Federal	*State*
Gray Wolf	*Canus lupus*	E	E
Canada Lynx	*Lynx canadensis*	T	T
Grizzly Bear	*Ursus arctos*	T	E
Western Gray Squirrel	*Sciurus griseus*		T
Keen's Myotis	*Myotis keenii* *		C
Townsend's Big-eared Bat	*Corynorhinus townsendii*		C
California Wolverine	*Gulo gulo luteus*		C
Bald Eagle	*Haliaeetus leucocephalus*	T	E
Marbled Murrelet	*Brachyramphus marmoratus marmoratus*[1]	T	E
American White Pelican	*Pelecanus erythrorynchos*		E
Ferruginous Hawk	*Buteo regalis*		T
Northern Spotted Owl	*Strix occidentalis caurina*	T	E
Western Grebe	*Aechmophorus occidentalis*		C
Northern Goshawk	*Accipiter gentilis*		C
Golden Eagle	*Aquila chrysaetos*		C
Merlin	*Falco columbarius*		C
Flammulated Owl	*Otus flammeolus*[2]		C
Vaux's Swift	*Chaetura vauxi*		C
Lewis' Woodpecker	*Melanerpes lewis*		C
Black-backed Woodpecker	*Picoides albolarvatus*		C
Pileated Woodpecker	*Dryocopus pileatus*		C
Bull Trout	*Salvelinus confluentus*	T	C
Chinook Salmon	*Oncorhynchus tshawtscha*	T	C
Pacific Fisher	*Martes pennanti*	C	E
Columbia Spotted Frog	*Rana luteiventris*	C	C
Western Toad	*Bufo boreas*		C
Johnson's Hairstreak	*Mitoura johnsoni* *		C

* Presence uncertain
[1] Westside only
[2] Eastside only

Appendix F – STATE LISTED PLANT SPECIES

The table below includes plants listed by the State of Washington, Natural Heritage Department. Elevation range, habitat, blooming time and state status are listed for each species. The state status is defined as follows:

Endangered: Any taxon in danger of becoming extinct or extirpated from Washington within the foreseeable future if factors contributing to its decline continue. Populations of these taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree.

Threatened: Any taxon likely to become Endangered in Washington within the foreseeable future if factors contributing to its population decline or habitat degradation or loss continue.

Sensitive: Any taxon that is vulnerable or declining and could become Endangered or Threatened in the state without active management or removal of threats.

Candidate: An animal taxon under review for listing.

Possibly Extinct or Extirpated from Washington: Based on recent field searches, a number of plant taxa are considered to be possibly extinct or extirpated from Washington. Taxa in this group are all high priorities for field investigations. If found, they will be assigned one of the above status categories.

Review: Plant taxon of potential concern, but for which no status has yet been assigned. Group 1 (i.e. **R1**) = Taxon in need of additional field work before a status can be assigned. Group 2 (i.e. **R2**) = Taxon with unresolved taxonomic questions.

Watch: Plant taxon that is more abundant and/or less threatened in Washington than previously assumed.

Scientific name	Common name	Elevation	Habitat	Blooming time	Washington State Status
Agoseris elata	Tall agoseris	5000'-7000'	Open moist woods, rocky or talus, shrubby slopes	June-August	Sensitive
Astragalus arrectus	Palouse milk vetch	1000'-4000'	Grassy hillsides, sagebrush flats openings in ponderosa pine or Douglas fir forest gravelly or sandy flats	Late April-June	Threatened
Aster sibiricus	Arctic aster	4000'-7200'	Open rocky gravelly places at high elevation	July-August	Sensitive
Botrychium lanceolatum	Lance-leafed moonwort	760'-6000'	Moist sites, alpine meadows	June-September	Watch
Botrychium lunaria	Common moonwort	3000'-6400'	Moist open areas in meadows and forests	June-September	Watch
Botrychium minganense	Moonwort	2000'-5700'	Moist sites in deciduous and coniferous forest, subalpine sites	June-September	Watch
Botrychium pedunculosum	Stalked moonwort	1600'-3000'	Moist wooded sites	June-September	Sensitive
Botrychium pinnatum	Northwestern moonwort	2100'-6500'	Dry to moist forest, subalpine meadows and alpine ridge tops	June-September	Watch

Scientific name	Common name	Elevation	Habitat	Blooming time	Washington State Status
Boytrichium simplex	Little moonwort	5000'-7000'	Moist to dry meadows bogs, swamps	June-September	Watch
Campanula lasiocarpa	Alaska harebell	6500'-7000'	Rock crevices in alpine zones	July-August	Sensitive
Carex atrosquama	Blackened sedge		Open wet meadows and dry slopes at moderate to high elevations	July-August	Review group 2
Carex buxbaumii	Buxbaum's sedge	700'-6200'	Bogs, marshes, wet meadows	June-August	Watch
Carex comosa	Bristly sedge	50'-2000'	Marshes, lake edges, wet meadows	July-August	Sensitive
Carex flava	Yellow sedge	2000'-4000'	Wet meadows, forested wetlands, bogs shores of streams and lakes	July-August	Sensitive
Carex heteroneura	Different nerved sedge	Moderate to high elevation	Wet meadows to dry slopes	June-August	Review group 2
Carex machrochaeta	Large awned sedge	600'-3200'	Open wet meadows, seeps, waterfalls	July-August	Threatened
Carex magellanica ssp. irrigua	Poor sedge	2000'	Bogs, sedge meadows, fens, spruce/sedge association	August	Sensitive
Carex norvegica	Norway sedge	4000'-6500'	Streambanks, seeps, moist meadows	July-August	Sensitive
Carex pluriflora	Several flowered sedge	100'-3100'	Marshes, streambanks, lake margins	July-August	Sensitive
Carex proposita	Smoky mountain sedge	6000'-8000'	Open rocky slopes, ridges, often on talus	July-August	Threatened
Carex saxatilis var. major	Russet sedge	2500'-5500'	Wet meadows, edges of streams and ponds, bogs	July-August	Watch
Carex scopulorum var. prionophylla	Mountain sedge	4600'	Moist-wet meadows, lakeshores, streambanks	July-August	Watch
Carex scirpoidea var. scirpoidea	Canadian single spike sedge	5000'-7200'	Moist meadows, streambanks, rocky slopes	July-August	Sensitive
Carex stylosa	Long styled sedge	2700'-6700'	Marshes, streambanks, bogs, wet depressions, seeps	August-September	Sensitive
Cicuta bulbifera	Bulb-bearing hemlock	240'-3700'	Edges of marshes, lakes, bogs, meadows shallow standing or slow moving water	August-September	Sensitive
Cimicifuga elata	Tall bubane	600'-3000'	Moist shady woods in mature or old growth coniferous deciduous forest	May-August	Sensitive
Coptis asplenifolia	Spleenwort-leaved goldthread	0'-3000'	Open rocky areas in moist coniferous forests	April-May	Sensitive
Corydalis aurea	Golden smoke	300'-6000'	Moist to dry well drained soil, gravelly open areas	May-July	Watch
Cryptogramma stelleri	Steller's rockbrake	3000'	Moist shaded cliffs, ledges, rocky slopes, often on limestone	June	Sensitive
Cypripedium faciculatum	Clustered lady slipper	1200'-5000'	Moist to dry and rocky open conifer forest	May-Mid-June	Sensitive
Cypripedium parviflorum	Yellow lady slipper	2100'-3400'	Bogs, seeps, margins of lakes and ponds, moist woods	May-June	Threatened
Dodecatheon pulchellum var. watsonii	Few flowered shooting star	5500'-7500'	Meadows and rock out crops subalpine and alpine	July	Watch
Draba aurea	Golden draba	6000'-7000'	Open to forested slopes, to alpine meadows	June-August	Sensitive

Scientific name	Common name	Elevation	Habitat	Blooming time	Washington State Status
Eleocharis atropurpurea	Purple spike rush	500' in CA	Wet ground, lake shores	Annual, early spring	Possibly extirpated
Epipactis gigantea	Giant hellebore	0'-4000'	Streambanks, lake shores, seeps, springs	April-July	Watch
Erigeron salishii	Salish fleabane	6000'-8000'	Dry alpine ridges	July-August	Sensitive
Eriophorum viridicarinatum	Green keeled cottongrass	2000'-6600'	Cold swamps and bogs	June-July	Sensitive
Eritrichium nanum var. elongatum	Pale forget-me-not	7000'-9000'	Open rocky places	June-August	Sensitive
Erythonium revolutum	Pink fawn lily	100'-200'	River banks, edge of woods, open or moderate shade	April-May	Sensitive
Fritallaria camschatcensis	Black lily	0'-3000'	Moist to wet meadow, open, riparian areas, tide flats	May-June	Sensitive
Galium kamtschaticum	Boreal bedstraw	1500'-2100'	Moist coniferous forest, seeps and areas of standing water	July-August	Watch
Gentiana glauca	Glaucous gentian	7000'-8000'	Tundra, dry to moist alpine areas	July-September	Sensitive
Githopsis specularioides	Common blue-cup	200'-2300'	Dry, open places in foothill, areas of thin soils, talus slopes	April-June	Sensitive
Potentilla diversifoia var. perdissecta	Diverse-leaved cinquefoil	6500'-8000'	Montane to alpine, rocky slopes, meadows and streambanks	June-August	Sensitive
Hackelia hispida var. disjuncta	Sagebrush stickseed	600'-2100'	Cliffs rocky, talus slopes grasslands to open forest	May-June	Sensitive
Hackelia venusta	Showy stickseed	1000'-2500'	Dry loose granitic sand and crevices in granite or talus, ponderosa pine forest	May-June	Endangered
Hypericum majus	Canadian St. John's wort	100'-2300'	Along ponds and lakeshores, riparian areas	July-September	Sensitive
Iliamna longisepala	Longsepal globemallow	500'-4500'	Sagebrush steppe, open hillsides, dry streams, open ponderosa and Douglas fir forest	June to August	Sensitive
Impatiens aurella	Orange balsam	Low elevation	Moist shaded areas	June-August	Review group 2
Limosella acaulis	Mudwort	< 4000'	Ponds edges, lakeshores, river edges in areas of slow moving water	May-November	Watch
Listera borealis	Northern twayblade	3000'-6500'	Moist woods in moderate to deep shade, along streams, associated with old growth or old second growth	June-July	Watch
Lycopodiella inundata	Bog clubmoss	1500'-6400'	Bogs, marshes pond margins	July	Sensitive
Lycopodium dendroideum	Treelike clubmoss	800'-3600'	Rock outcrops, talus fields, moss and significant debris layer	June-July	Sensitive
Luzula arcuata	Curved woodrush	timberline	Rocky garvelly soil, on moraines or alpine areas	July-August	Sensitive
Mimulus pulsiferae	Pulsifer's Monkey-Flower	1000'-2000'	Seasonally moist, open places in foothills, and openings in ponderosa Pine/Douglas fir forest	June-July	Sensitive
Mimulus suksdorfii	Suksdorf's monkey flower	2000'-4000'	Moist areas in sagebrush steppe/ponderosa Pine forest	May-August	Sensitive

Scientific name	Common name	Elevation	Habitat	Blooming time	Washington State Status
Mimulus washingtonensis	Washington monkey-flower	Low elevation	Wet to moist places at low elevation	May-September	Possibly extirpated
Orthocarpus bracteosus	Rosy owl's clover	1500'-2500'	Moist meadows at low elevation in transition zone between wetland and upland	June-August	Endangered
Parnassia kotzebuei var. kotzebuei	Kotzebue's grass-of parnassus	No data available	Alpine areas	July-September	Sensitive
Pellea brachyptera	Sierra cliff brake	770'-2200'	Dry Rocky slopes, talus, outcrops in Douglas fir and ponderosa Pine forest	August-September	Sensitive
Penstemon eriantherus var. whitedii	Fuzzy-tongued penstemon	3500'	Open sagebrush shrub, open areas in valleys and foothills	May-July	Sensitive
Petrophyton cinerascens	Chelan rockmat	800'-1800'	Ledges and crevices of cliffs and rocky outcrops	July-August	Endangered
Pinguicula vulgaris	Common butterwort	1500'-7000'	Moist seeps, meadows and talus slopes	July-August	Watch
Planthera obtusata	Small northern bog orchid	800'-5000'	Moist places in forests, bogs, streambanks, marshes, meadows	June-July	Sensitive
Pleuricospora fimbriolata	Sierra sap	1000'-4000'	Dry coniferous forest with little understory	July-August	Watch
Poa arctica ssp. arctica	Gray's bluegrass		Alpine ridges		Review group 2
Polemonium viscosum	Skunk polemonium		Open rocky place in high elevation, mostly above timberline	July-August	Sensitive
Potemogeton obtusifolius	Blunt leaved pondweed	50'-2000'	Waters of lakes and slow moving streams	August-September	Sensitive
Ranuculus cooleyea	Cooley's buttercup	1500'-6000'	Moist slopes and rock crevices	July-August	Sensitive
Salix tweedyi	Tweedy's willow	5200'-'7200'	Streambanks moist meadows in mid to high elevation meadows	June-July	Sensitive
Salix vestita var. erecta	Rock willow	High elevation	Open moist areas in springs or wetlands near or above timberline	July-September	Possibly extirpated
Sanicula marilandica	Black snake-root	2900'-5200'	Low moist ground, meadows, marsh edges, riparian flood plains	June-August	Sensitive
Saxifraga integrifolia var. apetala	Swamp saxifrage	5900'-6500'	Vernally moist meadows, seeps and ephemeral streams	March -July	Watch
Saxifraga rivularis	Pygmy saxifrage	5500'-7000'	Damp cliffs, shaded rock outcrops, talus near snow banks, moist meadows	July-August	Sensitive
Saxifragopsis fragarioides	Strawberry saxifrage	1400'-4500'	Crack and crevices on cliffs and rock outcrops in ponderosa pine and Douglas fir forest.	June-July	Threatened
Silene seelyi	Seely's silene	1500'-6300	Cliffs and talus slopes	May-August	Sensitive
Spiranthes porrifolia	Western ladies tresses	60'-6800'	Meadows, seeps streams	May-August	Sensitive
Swertia perennis	Swertia	4000'	Montane to subalpine meadows, streambanks	July-August	Review group 1
Trifolium thompsonii	Thompson's clover	140'-4000'	Open to sparsely wooded sagebrush community, near edges of the ponderosa pine zone	May-June	Threatened
Utricularia minor	Lesser bladderwort	300'-2000'	Shallow standing or slowly moving water	June-September	Review group 1

Appendix G – MINIMUM REQUIREMENT ANALYSIS

The Stephen Mather Wilderness area encompasses 93% of the North Cascades National Park Service Complex. Consistent with NPS policies, all management actions affecting the Stephen Mather Wilderness must comply with the minimum requirement concept in the Wilderness Act of 1964. This concept, derived from section 4(c) of the Wilderness Act, prohibits certain nonconforming uses of wilderness "except as necessary to meet the minimum requirements for the administration of the area." To determine the minimum requirement for management of wilderness areas, NPS Management Policies require a Minimum Requirement Analysis before taking action.

The 2004 "Minimum Requirement Decision Guide," developed by the Arthur Carhart National Wilderness Training Center, was used to guide this analysis. The Minimum Requirement Analysis is a two-step process used to document whether administrative activities affecting wilderness resources or values are necessary, and how to best minimize impacts. Step one analyzes whether the proposed action is appropriate or necessary for administration of the area as wilderness. Step two evaluates techniques and types of equipment needed for the action to ensure that impact to wilderness resources and character is minimized. This second step is often referred to as a "minimum tool" analysis.

Proposed actions that could impact wilderness and thus were analyzed using the minimum requirement process include prescribed burning above Stehekin (Stehekin Contours), prescribed burning above Hozomeen and Lightning Creek (Hozomeen Contours), and the re-ignition of suppressed fires (Re-ignition). Wildland fire use and suppression activities could also likely impact wilderness; however, since these activities are deemed emergency situations they do not have to go through the minimum requirement decision process. Instead, the minimum requirement concepts are incorporated into emergency plans as Minimum Impact Tactics (MIT). Minimum impact tactics are used to ensure the minimum necessary methods and tools are being utilized to meet the needs of the emergency. See Appendix I for a list of MIT.

STEP 1: MINIMUM REQUIREMENT – Determine if it is necessary to take action

Description: Briefly describe the situation that may prompt action.

Over the last century, fire suppression and other historic human activities (e.g. selective harvesting) have influenced fire regimes within the Complex. Some areas are showing signs of being outside their historical range of variability, with increased fuel loads, large pockets of disease, and large insect infestations. Most altered are those areas surrounding communities, where fire suppression has been most effective. Should a fire ignite in one of these areas, a large, high intensity fire could occur and cause resource damage beyond what normally would have occurred under historic conditions.

Of greatest concern are the areas surrounding Stehekin and Hozomeen, both of which are listed in the Federal Register as wildland-urban interface communities within the vicinity of federal lands that are at high risk from wildfire. Around Stehekin, fire suppression has caused excessive fuel loading and increased the risk of a large, unnaturally severe fire that could impact wilderness values. Such a fire could burn into the community, where under the right conditions there could be significant loss of property and perhaps human lives. These risks have prompted the NPS to adopt a very precautionary position concerning the role of wildfire in the wilderness surrounding the Stehekin community. This policy has led to fire suppression in areas well outside the lower Stehekin Valley. Many fires that would be excellent candidates for wildland fire

use have been suppressed to protect Stehekin. Fire suppression has also taken place frequently surrounding Hozomeen. Although the forests above Hozomeen and Lightning Creek are still within their natural range of variability, additional fire suppression could move them closer to being outside of their natural range and thus could further impact wilderness values. The proposed Stehekin and Hozomeen contours projects are intended to restore and/or maintain fire-dependent ecosystem processes in areas where fire typically isn't allowed to burn because of the potential risks to human life, property, and resource damage. The proposed re-ignition projects are intended to restore fire processes to areas which could become altered or are already altered from continued fire suppression.	
A. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation ***Are there valid existing rights or is there a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that <u>allows</u> consideration of action involving Section 4(c) uses? Cite law and section.***	Yes: ☐ No: ☒ Not Applicable: ☐ ***Explain***: There are no valid existing rights or special provisions of wilderness legislation allowing the proposed actions.
B. Describe Requirements of Other Legislation ***Do other laws require action?***	Yes: ☐ No: ☒ Not Applicable: ☐ ***Explain***: There are no other acts that require or prohibit this action.
C. Describe Other Guidance ***Does taking action conform to and implement relevant standards and guidelines and direction contained in agency policy, unit and wilderness management plans, species recovery plans, tribal government agreements, state and local government and interagency agreements?***	Yes: ☒ No: ☐ Not Applicable: ☐ ***Explain***: NPS Management Policies 2001 directs NPS to re-establish natural functions and processes in human-disturbed components of natural systems; The National Fire Plan mandates agencies to protect nationally identified communities at risk and requires that firefighter and public safety be the highest priority in any fire management decision.
D. Describe Options Outside of Wilderness ***Can this situation be resolved by action outside of wilderness?***	Yes: ☐ No: ☒ Not Applicable: ☐ ***Explain***: Fire is an essential ecosystem process that cannot be duplicated elsewhere.
E. Wilderness Character ***How would action contribute to the preservation of wilderness character (as described by the following components: untrammeled, undeveloped, natural, outstanding opportunities for solitude or a primitive and unconfined type of recreation, or other unique components)?***	The proposed prescribed fire treatments would both diminish and enhance different aspects of wilderness character. The quality of being untrammeled, or "wildness," would diminish through the intentional manipulation of igniting fires. The quality of "naturalness" would be enhanced by returning the natural process of fire to wilderness.

F. Describe Effects to the Public Purposes of Wilderness ***How would action support the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?***	Some of the proposed projects could temporarily impact recreation by limiting trail access, creating bothersome smoke, and disruptive helicopter activity; scenic values would be impacted by burn scars on the landscape (negative or positive impacts depending on the observer); scientific values would be enhanced through increased understanding of prescribed burning and its benefits and/or adverse impacts; conservation would be supported by returning the process of fire to the landscape; historical/educational value in describing past management decisions, fire history, and new management paths.

MINIMUM REQUIREMENT DECISION: Is it necessary to take action?

Yes: ☒ No: ☐ Not Applicable: ☐

Explain: The proposed actions, prescribed burning of the Stehekin and Hozomeen contours and re-ignition of suppressed fires, are deemed necessary at this time for several reasons. Through the restoration of the natural processes associated with fire (and consequently, the removal of unnatural levels of fuels), both Stehekin and Hozomeen residents/visitors will be further protected from a potentially large, high intensity fire that could move into either community and put lives and/or property at risk. The impacts of fire exclusion on fire-dependent species would be minimized by both of the proposed projects. These actions are consistent with NPS Management Policies and National Fire Plan mandates. Conducting these projects outside of wilderness would not reduce the need for them within wilderness. The proposed projects would have short-term, negative impacts on wilderness character and the public purposes of wilderness by the intentional manipulation of wilderness through human fire ignitions. Conversely, the proposed projects would provide long-term enhancement of the naturalness of the wilderness by reducing the impacts of fire suppression and exclusion and allowing natural processes to resume.

If action is necessary, proceed to Step 2 to determine the minimum tool for action.

STEP 2: MINIMUM TOOL

For this portion of the analysis, four options were initially developed to accomplish the proposed actions. The options range from traditional or primitive tools only (reliance on human or animal power), to unrestricted use of modern tools (mechanical or motorized transport and motorized equipment). Also included is a "no action" option. Examples of traditional and modern tools are listed below.

Traditional/Primitive Tools	Modern Tools
Foot travel and stock transport	Aircraft (helicopters, fixed-wing airplanes), mechanical transport (wheel barrows)
Hand tools/mechanized tools (handheld saw, crosscut saw, axes, shovels, Pulaskis, gravity socks)	Motorized tools (chainsaws, water pumps, electrical equipment powered by generators)
No structures or installations	Structures and installations (monitoring markers (rebar), remote automated weather stations, webcams, radio communication repeaters)
Handheld ignition devices (drip torches, fusees)	Aerial ignition (helicopter with sphere dispenser)

Because the proposed actions could have different impacts, they are analyzed separately in *STEP 2*. Stehekin and Hozomeen contours are analyzed as one action (A), and Re-ignition is analyzed as another action (B). Under both actions, Option 1: No Action and Option 4: Unrestricted Use, are rejected as viable options. No Action is rejected because it fails to comply with NPS policies and National Fire Plan policies. Unrestricted Use is rejected as an option because it does not meet the spirit and intent of the Wilderness Act or NPS policies.

A. STEHEKIN AND HOZOMEEN CONTOURS

Option 1: No action (REJECTED)

No prescribed fire projects would be implemented. Altered fire regimes would continue to worsen and put Stehekin and Hozomeen at a greater risk for a high intensity fire moving into either community. Extreme fire behavior would be likely, and suppression would be the primary management response. Wildland fire use would be an unlikely option. The exclusion of fire would continue to alter natural conditions, with widespread impacts to wilderness character.

Option 2: Primitive tools only

1. ***Describe what methods and techniques will be used***

   Fire staff will access the units on foot where possible. Stock could be used to transport supplies to the burn team in certain units near trails. Preparation work such as tree falling or cutting and bucking of debris would be conducted using hand tools. Units would be ignited with hand-held drip torches. Burning would be directed by a burn boss positioned on a lookout across the valley from the burn. Patrol and mop-up would utilize ground resources only. No structures or installations would be used.

2. ***When the action will take place***

   Prep work will occur between April and October, depending on the mitigation measures that are needed. The majority of burning will occur in the fall. Some black lining will occur during the spring season.

3. ***Where the action will take place***

   Stehekin Contours, Hozomeen Contours (see maps in Appendix A)

4. What mitigation measures are necessary

- Project work during heavy visitor use would be avoided if possible
- Project work around nesting wildlife (e.g. spotted owls) will be avoided
- Follow MIT, specifically in regard to rehab of fire line
- Saw cuts will be camouflaged as much as possible in high visibility areas
- When possible, prescribed fire will be timed so it precedes season-ending rain or snow events to avoid the effects of additional mop-up and patrol on wilderness character, and to decrease smoke impacts on non-wilderness visitors

5. General effects to wilderness character

Impacts to wilderness character would be mixed. Short-term impacts to wilderness character would be minimal with regard to mechanical noise and activity, but staff presence would be longer and there would be a greater number of person-days to complete prep/implementation work. The quality of wildness would be negatively impacted by the intentional lighting of fires for specific management purposes. Impacts to wilderness character in the long-term would be greater, since conducting most of the proposed project work would be logistically infeasible and dangerous (due to the steepness and inaccessibility of the terrain). Naturalness of the wilderness would diminish over time as fuels would continue to build up and natural processes and relationships would be hindered or changed.

EFFECTS:

Biological and Physical Resource: Due to the logistical problem of not being able to reach the entirety of most units because of steepness and inaccessibility, much of the units would remain untreated. Long-term impacts to ecological processes would result from fire exclusion. For example, fuels would continue to accumulate as fires are suppressed, and the resulting changes in stand structure and composition may result in loss of fire-dependent communities.

Social and Experiential Resource: Visitor experience would be least impacted under this option since much of the project work is infeasible. Trail closures would still impact visitors, however, and prescribed fire personnel positioned near trails could impact solitude. Long-term impacts to solitude could become greater if more suppression actions are necessary in order to prevent wildfires from moving into Stehekin or Hozomeen. Some visitors might notice a change in wilderness character, as fuels increase and the forest becomes increasingly unhealthy, or as unnaturally intense wildfires occur.

Heritage and Cultural Resource: Several cultural resource sites are known to exist within project boundaries. Since these areas are reachable by foot, they could be impacted by project activities under this option. Impacts could include scorching, melting, or incineration of features and/or artifacts, and exfoliation of rock art or other rock features. Other impacts could include trampling of sites by fire personnel, ground disturbance due to digging of fire line, and obstruction of sites by downed vegetation. Known sites will be avoided and/or protected during project work.

Maintaining Contrast and Unimpaired Character: This option would provide a contrast between wilderness and other areas through the use of primitive tools. However, due to the use of primitive tools only, large portions of the units would not be treated, which would result in impairment of wilderness character due to fire exclusion, and an increased risk of prescribed fire escape and unwanted fire suppression effects.

Special Provisions: There are no special provisions applicable to the proposed actions.

Safety of Visitors, Personnel, and Contractors and Work Methods: Since the proposed burn units are located on steep, rugged terrain, the majority of areas cannot be burned safely with primitive tools (i.e., personnel on the ground only). Personnel would be exposed to a greater risk from rolling and/or falling debris. The use of primitive tools only will not provide the highest suppression response necessary to protect values at risk (people, property, listed species habitat, cultural resources, etc) from escaped prescribed fire.

Economic and Time Constraints: More staff time would be required to conduct prep work using primitive tools, requiring 2-3 times the budget than more modern techniques.

Additional Wilderness-specific Comparison Criteria: The proximity of the project areas to communities is a factor that needs to be considered.

Option 3: Combination of primitive tools and restricted use of modern tools

1. ***Describe what methods and techniques will be used***

   Fire staff will access the units on foot where possible and via helicopter in steep areas. Prep work will include chainsaw use for falling/bucking trees, hand tools for limited line construction, some black lining using drip torches or aerial ignition devices (via helicopter), and water pumps for securing lower boundaries. Ignition will occur primarily via helicopter. Patrol will occur with ground resources augmented with helicopter use in steep areas. Mop-up activities will be conducted with hand tools, bladder bags, and helicopter bucket drops to prevent fire from escaping the unit boundary. Monitoring will be conducted by a burn boss aboard the helicopter as the unit is ignited. A temporary automated weather station may be installed.

2. ***When the action will take place***

   Prep work will occur between April and October, depending on site specific mitigation measures required. The majority of burning will occur in the fall. Some black lining will occur during the spring season.

3. ***Where the action will take place***

   Stehekin Contours, Hozomeen Contours (see maps in Appendix A).

4. ***What mitigation measures are necessary***

   - Project work during heavy visitor use would be avoided if possible
   - Project work around nesting wildlife (e.g. spotted owls) will be avoided
   - Follow MIT for fire management, specifically in regard to rehab of fire line
   - Saw cuts will be camouflaged as much as possible in high visibility areas
   - Pumps will not be deployed until a few days before the planned burn execution, and will only be used as needed
   - Portable pumps (and associated fuel cans) will be placed on plastic/absorbent sheeting to prevent fuel spills onto the ground or into streams
   - The portable weather station will be located in an unobtrusive area away from visitor view
   - Helicopter flight time will be minimized by combining flight missions

- When possible, prescribed fire will be timed to precede season-ending rain or snow events to avoid the effects of additional mop-up and patrol on wilderness character

5. General effects to wilderness character

Impacts to wilderness character would be mixed. Short-term noise impacts from helicopter, chainsaw, water pump use, and staff presence would occur during all phases of the prescribed burn. Some rehabilitated fire lines could cause medium-term impacts to wilderness character through evidence of human activity, increased chances of erosion, and the potential to establish non-native plant species. The quality of wildness would be negatively impacted by the intentional lighting of fires for specific management purposes. Wilderness character would benefit in the long-term by returning fire to the landscape, enabling more natural fire regimes to exist.

EFFECTS:

Biological and Physical Resource: Treatment of the proposed areas would return fire to an area in which it has historically been excluded. Long-term benefits to ecological processes would result from fuel reduction in altered stands and maintenance of fire-dependant species and their communities.

Social and Experiential Resource: Visitor experience, especially solitude, would be most impacted under this option since much of the project work is conducted via helicopter. Trail closures would also impact visitor experience, as well as fire staff traveling along trails. Long-term impacts to solitude could diminish if fewer suppression actions are necessary. Wilderness character would change, as the areas burned become more visible, fuels decrease, and openings are created in the forest.

Heritage and Cultural Resource: Cultural resource sites are known to exist within project boundaries. Impacts could include scorching, melting, or incineration of features and/or artifacts, and exfoliation of rock art or other rock features. Other impacts could include trampling of sites by fire personnel, ground disturbance due to digging of fire line, and obstruction of sites by downed vegetation. Known sites will be avoided and/or protected during project work.

Maintaining Contrast and Unimpaired Character: This option would provide a contrast between wilderness and other areas through restoration of fire and ecosystem processes. Wilderness character would become less impaired.

Special Provisions: There are no special provisions applicable to the proposed actions.

Safety of Visitors, Personnel, and Contractors and Work Methods: The use of modern tools, such as helicopters, would decrease the number of personnel placed in steep, rugged terrain, thereby reducing the risk of injury. Helicopter ignition will also provide a faster and safer means of igniting the entire unit. Community protection from large, high intensity wildfire would increase once the units are treated. Under this option, the highest suppression response would be available to protect values at risk (people, property, listed species habitat, cultural resources, etc) from escaped prescribed fire.

Economic and Time Constraints: The length of time spent in wilderness conducting project work would be less. Employing helicopters to ignite units enables fire managers to meet critical weather and prescription parameters that are difficult to meet with ground resources only.

Additional Wilderness-specific Comparison Criteria: The proximity of the project areas to communities is a factor that needs to be considered.

Option 4: Unrestricted use of modern tools (REJECTED)

Conducting the prescribed burn projects with no restrictions on modern tools would be timely and cost-effective. However, the impacts to wilderness character would be unacceptable. Helicopter use, chainsaw activity, and water pump use would increase, resulting in impacts to visitor experience, especially solitude and primitive types of recreation.

MINIMUM TOOL DECISION: A. Stehekin and Hozomeen Contours

The option that meets the minimum requirements necessary to administer the area as wilderness is the *combination primitive/traditional and restricted use of modern tools* option.

Rationale: The selected option utilizes a combination of tools that will provide the safest and the most logistically sound means of implementing the prescribed burns while minimizing impacts to wilderness. Efficient timing and lighting techniques will avoid smoke impacts and reduce the amount of time required to conduct burn activities overall. The quality of naturalness will be enhanced through the efficiency of using a combination of tools to reduce fuels and enhance fire-dependent communities while maintaining firefighter and community safety. Option 2, primitive tools only, would result in greater risk to personnel, greater risk to communities, and unwanted fire effects.

Describe any monitoring and reporting requirements *(Report these numbers annually to the Wilderness District Ranger)**:***

- Over flight hours
- Number of helicopter landings
- Chainsaw hours
- Water pump hours
- Map of constructed and rehabilitated fire line

Please check any Wilderness Act Section 4(c) uses approved in this option:

☐ mechanical transport	☒ landing of aircraft
☒ motorized equipment	☐ temporary road
☐ motor vehicles	☒ structure or installation
☐ motorboats	

Be sure to record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

B. RE-IGNITION

Option 1: No action (REJECTED)

No re-ignitions would be implemented. Opportunities for reversing the impacts of fire exclusion in certain areas would be lost. Lightning ignitions that occur in unaltered systems, but have to be

extinguished for logistical, resource, or political concerns, could not be re-ignited at a later time when the fire would be allowed to burn. Natural ignitions that occur in altered systems and are suppressed would also not be re-ignited during a time when fire behavior wouldn't be extreme. Landscapes would continue to be shaped by fire suppression, and natural systems would become altered. Wilderness character would change.

Option 2: Primitive tools only

1. ***Describe what methods and techniques will be used***

   Fire staff will access the suppressed fire perimeter on foot where possible. Stock could be used to transport supplies to the burn team in areas that are located near trails. In order to protect specific values at risk (such as cultural sites, rare species locations, a trail bridge, etc) occasional suppression actions may be necessary, and the associated prep work such as tree falling or cutting and bucking of debris would be conducted using hand tools. The perimeter would be ignited with hand-held drip torches. Burn monitoring would be conducted on the ground when deemed safe. Patrol and mop-up would utilize ground resources only. No structures or installations would be used.

2. ***When the action will take place***

   Prep work will occur as identified in the Wildland Fire Implementation Plan during July, August and September.

3. ***Where the action will take place***

   Potentially anywhere within the Wildland Fire Use Zone (see maps in Appendix A).

4. ***What mitigation measures are necessary***

   - Project work during heavy visitor use would be avoided if possible
   - Project work around nesting wildlife (e.g. spotted owls) will be avoided
   - Follow MIT, specifically in regard to rehab of fire line
   - Saw cuts will be camouflaged as much as possible in high visibility areas

5. ***General effects to wilderness character***

   Impacts to wilderness character would be mixed. Short-term impacts would be minimal with regard to mechanical noise and activity and staff presence. Impacts to wilderness character in the long-term would be greater, since many re-ignition sites would be inaccessible on foot (due to the steepness and inaccessibility of the terrain), and fire would be excluded from the landscape in some areas. Naturalness of the wilderness would diminish over time. The quality of wildness would remain largely intact since most sites would not be re-ignited due to logistics.

EFFECTS:

Biological and Physical Resource: Due to the logistical problem of not being able to reach many of the re-ignition sites by foot, most suppressed fires would not be re-ignited. Long-term impacts to ecological processes would result from fire exclusion in some areas. For example, fuels would continue to accumulate in certain areas where fires are often suppressed, and the resulting changes in stand structure and composition may result in loss of fire-dependent communities.

Social and Experiential Resource: Overall***,*** visitor experience would be least impacted under this option since much of the project work is infeasible. For those projects that are feasible using primitive tools, trail closures or fire staff along trails could impact solitude. However, this option

would likely impact very few visitors.

Heritage and Cultural Resource: Potential re-ignition sites would be surveyed for cultural resources prior to project implementation. Impacts could include scorching, melting, or incineration of features and/or artifacts, and exfoliation of rock art or other rock features. Other impacts could include trampling of sites by fire personnel, ground disturbance from fire line digging, and obstruction of sites by downed vegetation. Known sites will be avoided and/or protected during project work.

Maintaining Contrast and Unimpaired Character: This option would not provide contrast because very few fires would be candidates for re-ignition using foot travel only. Impacts from fire suppression (i.e., fire exclusion) would not be mitigated by re-ignition.

Special Provisions: There are no special provisions applicable to the proposed actions.

Safety of Visitors, Personnel, and Contractors and Work Methods: Since most re-ignition sites would likely be located on steep, rugged terrain, the majority of areas could not be burned safely with primitive tools (i.e., personnel on the ground only). Escape routes could be difficult to identify in many areas due to the terrain.

Economic and Time Constraints: More staff time would be required to protect identified natural and cultural features from fire, which would otherwise result in unwanted loss.

Additional Wilderness-specific Comparison Criteria: The proximity of the re-ignition site to communities is a factor that needs to be considered.

Option 3: Combination of primitive tools and restricted use of modern tools

1. ***Describe what methods and techniques will be used***

   Fire staff will access the re-ignition site on foot where possible and via helicopter in hazardous areas. Ground personnel will ignite the perimeter with a drip torch. Where ignition is too hazardous for ground personnel, a helicopter with sphere dispenser will be employed. Helicopters may be used to transport fire personnel to complete prep work. In order to protect specific values at risk (such as cultural sites, rare species locations, a trail bridge, etc) occasional suppression actions may be necessary, and the associated prep work will include chainsaw use for falling/bucking trees, hand tools for limited line construction, and water pumps for securing natural and cultural features. Mop-up activities will be conducted with hand tools, bladder bags, and helicopter bucket drops. A temporary automated weather station may be installed.

2. ***When the action will take place***

   Prep work will occur as identified in the Wildland Fire Implementation Plan during July, August and September.

3. ***Where the action will take place***

   Potentially anywhere within the Wildland Fire Use Zone (see maps in Appendix A).

4. ***What mitigation measures are necessary***

   - Project work during heavy visitor use would be avoided if possible

- Follow MIT, specifically in regard to rehab of fire line
- Saw cuts will be camouflaged as much as possible in high visibility areas
- Portable pumps (and associated fuel cans) will be placed on plastic/absorbent sheeting to prevent fuel spills onto the ground or into streams
- Any portable weather station will be located in an unobtrusive area away from visitor view
- Helicopter flight time will be minimized by combining flight missions

5. General effects to wilderness character

Impacts to wilderness character would be mixed. Short-term noise impacts from helicopter and staff presence would occur when igniting the perimeter. Longer-term noise impacts from water pumps and chainsaw use would occur if natural and cultural features need to be protected. Disturbance would also occur from aircraft that may be used to monitor the progress of the re-ignited fire. Some rehabilitated fire lines could cause medium-term impacts to wilderness character through evidence of human activity and increased chances of erosion. Wilderness character would benefit in the long-term by returning fire to the landscape, thus enabling more natural fire regimes to exist; however, the quality of wildness would diminish with an increase in human manipulation.

EFFECTS:

Biological and Physical Resource: Through re-ignition of suppressed fires, the impacts of fire exclusion in a particular area would be minimized. Long-term benefits to ecological processes would result from fuel reduction in altered stands and maintenance of fire-dependent species and their communities.

Social and Experiential Resource: Visitor experience, especially solitude, would be most impacted under this option because of helicopter activity. Trail closures could also impact visitor experience, as well as fire staff traveling along trails. Wilderness character would change as the areas burned become more visible and openings are created in the forest.

Heritage and Cultural Resource: Potential re-ignition sites would be surveyed for cultural resources prior to project implementation. Impacts could include scorching, melting, or incineration of features and/or artifacts, and exfoliation of rock art or other rock features. Other impacts could include trampling of sites by fire personnel, ground disturbance due to digging of fire line or setting up and using water pumps and hose, helicopter bucket water drops, and obstruction of sites by downed vegetation. Known sites will be avoided and/or protected when accomplishing this work.

Maintaining Contrast and Unimpaired Character: This option would provide contrast between wilderness and other areas by allowing fire to play a role in the ecosystem. If a fire has to be suppressed, this option would help to mitigate the impacts of fire exclusion on wilderness character.

Special Provisions: There are no special provisions applicable to the proposed actions.

Safety of Visitors, Personnel, and Contractors and Work Methods: The use of modern tools, such as helicopters, would reduce the potential of injuring personnel who would otherwise be placed in steep, rugged terrain. Ground personnel would be employed to ignite the perimeter only where it can be done safely. Under this option the objectives of the Wildland Fire

Implementation Plan could be safely met by providing the option for aircraft, chainsaw, and water pump use.

Economic and Time Constraints: The length of time spent in wilderness conducting the re-ignition work would be less than the amount of time that would be required using ground personnel only.

Additional Wilderness-specific Comparison Criteria: The proximity of the re-ignition site to communities is a factor that needs to be considered.

Option 4: Unrestricted use of modern tools (REJECTED)

Conducting re-ignitions with no restrictions on modern tools would be timely and cost-effective. However, the impacts to wilderness character would be unacceptable. Helicopter use, chainsaw activity, and water pump use would increase, resulting in impacts on visitor experience, especially solitude and primitive types of recreation.

MINIMUM TOOL DECISION: B. Re-ignition

The option that meets the minimum requirements necessary to administer the area as wilderness is the *combination primitive/traditional and restricted use of modern tools* option.

Rationale: The selected option utilizes a combination of tools that will provide the most efficient means of implementing re-ignitions while minimizing impacts to wilderness. Ground personnel will be utilized where it is safe and appropriate, and helicopters will be utilized in more hazardous terrain. The quality of naturalness will be enhanced as fire-dependent communities are maintained by allowing fire to play some role in the system (rather than being excluded through suppression). Option 2, primitive tools only, would result in greater risk to personnel and greater risk of negatively impacting natural and cultural resources.

Describe any monitoring and reporting requirements *(Report these numbers annually to the Wilderness District Ranger)**:***

- Over flight hours
- Number of helicopter landings
- Chainsaw hours
- Water pump hours
- Map of constructed and rehabilitated fire line

Please check any Wilderness Act Section 4(c) uses approved in this option:

☐ mechanical transport	☒ landing of aircraft
☒ motorized equipment	☐ temporary road
☐ motor vehicles	☒ structure or installation
☐ motorboats	

Be sure to record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

MINIMUM REQUIREMENT/MINIMUM TOOL SUMMARY
The Stehekin and Hozomeen contours projects, as well as re-ignition, are deemed the minimum requirements necessary to administer the Stephen Mather Wilderness. These actions are consistent with NPS Management Policies and National Fire Plan mandates. A combination of primitive/traditional and restricted use of modern tools was selected as the option that meets the minimum requirements necessary to administer the area as wilderness. The proposed projects would negatively impact wilderness character and the public purposes of wilderness by the intentional manipulation of wilderness through human fire ignition, but also would enhance the naturalness of wilderness by reducing the effects of fire suppression and exclusion.

Approvals	Signature	Name	Position	Date
Prepared by:		Cathi Jones	Resource Management Specialist	
Recommended:		Tim Manns	Wilderness Committee Chair	
Recommended:		Tod Johnson	Fire Management Officer	
Approved by:		Bill Paleck	Superintendent	

Appendix H – MINIMUM IMPACT TECHNIQUES (MIT)

The following guidelines include the nationally recognized MIST (Minimum Impact Suppression Tactics) techniques for fire suppression augmented with guidelines specific to North Cascades National Park Service Complex (the Complex). These guidelines, written by and agreed upon by Complex staff, are to be used for suppression and wildland fire use activities (including monitoring efforts), and are to be considered during the implementation of prescribed fire and the re-ignition of suppressed fires.

WILDLAND FIRE USE (WFU) GUIDELINES

If an unplanned ignition in the Complex has been specified as WFU the strategy for monitoring the fire is selected and documented in the implementation plan. The minimum tool for monitoring WFU fires that cannot be safely or adequately observed from the ground by existing lookouts or other qualified field staff will be either:

1) Aircraft overflights, or
2) WFU monitors

The recommendation to place WFU monitors via aircraft will be made by a team consisting of the Fire Management Officer or Fire Use Manager, the Wilderness District Ranger (or delegate) and a delegate from the Resource Management Division. It is recognized that, depending on the location of the WFU and many other factors, either regular overflights *or* fire monitors placed on the ground could be the minimum tool for monitoring. If the minimum tool selected is to place monitors at an observation point, it will be done so as to provide accurate and timely information to the Fire Use Manager and to reduce the number of aircraft overflights required to manage the incident.

Considerations the team will use as criteria for selecting monitoring by aircraft or placing on-the-ground monitors include:

- Location of the fire within the Complex, aspect, fuels, and potential for fire moving in the direction of values at risk
- Frequency and type of observation required by the line officer
- Sensitivity of natural resources to long-term residence by monitors
- Proximity of the observation point to primary access trails and known, visitor-used cross-country routes
- Other time or resource specific concerns

Guidelines for WFU monitors:

- Monitors placed by aircraft will go in with supplies to sustain their work and personal needs for at least a period of seven days.
- Food storage containers (wildlife resistant) will be used. In addition to the containers located at the Fire Cache, these may be available from the Wilderness or Trails programs.
- Other camping guidelines (use of fires, human waste management, site selection, etc) will follow what is outlined in the Complex's Wilderness Management Plan (these camping guidelines are available in handouts) and standard Leave No Trace literature (available from Wilderness Information Center). In other words, fire monitors will follow the same guidelines as other backcountry users and Complex workers.

MINIMUM IMPACT TACTICS (MIT)

Establishing and Setting Up Camp

- Ideally a Resource Advisor from the Complex will advise the camp manager for prolonged suppression efforts, typically type 1, 2, and 3 incidents. If a type 4 incident requires a prolonged presence in a sensitive area, then a qualified Resource Advisor will provide direction to the incident commander through the incident action plan to reduce or prevent unwanted impacts.
- Consider impacts on both present and future visitors, as well as wildlife and vegetation. An agency commitment to wilderness values will promote those values to the public.
- Whenever possible, avoid establishing spike or coyote camps in wilderness.
- If wilderness camps are unavoidable, use existing, or previously impacted campsites.
- If existing campsites are not available, use the local Resource Advisor to help identify the most resilient sites on rocky or sandy soils.
- Always select sites that are unlikely to be observed by wilderness visitors.
- Avoid camping in wet meadows, in subalpine / alpine vegetation, over biological soil crusts, along streams, or on lake shores.
- Layout camp components carefully from the start. Define cooking, sleeping, and latrine areas; define water supplies.
- Limit travel ways within, to, and from camp. Walk in a dispersed fashion whenever possible rather than single file to avoid trail development.
- Minimize disturbance to land in preparing bedding and campfire sites. Do not clear vegetation, trench, or excavate a flat spot to create bedding sites.
- Place indoor-outdoor carpet, scrim, or other material on the ground to protect vegetation in the most heavily traveled areas of camp; i.e., kitchen, campfire, and washing-up areas.
- Resource advisors should work with cache personnel during the off-season to ensure that tents are cleaned of any noxious weed seeds prior to being sent to a wilderness fire.
- Do not use nails in trees.

Washing

- Use designated personal washing areas if provided.
- In small spike camps or coyote camps, carry water and bathe away from lakes and streams.
- Do not introduce soap, shampoo, or other personal grooming chemicals into waterways.
- If a large camp is employed, designate a common area for personnel to wash up. Provide fresh water, biodegradable soap, and a place for waste water. Washing areas should be located near the kitchen area, to concentrate smells that attract wildlife in one location.
- Devise a plan for disposing of waste water from kitchen and washing areas.

Human waste management

- If a large number of firefighters are using a spike camp and the camp is being serviced by helicopter, fly in portable backcountry latrines, and fly out human waste as necessary. If the camp does not have air support, establish community latrines well away from water sources (200-foot minimum), rather than leaving it up to the individual. OR:
- Crews will follow suggested methods in place for other work crews and visitors. These are outlined in materials from the Wilderness Information Office if needed. Crews in sensitive subalpine, non-designated camps or other areas where cat-holes are not feasible may be supplied with a composting toilet if a prolonged camp is expected. The toilet would be maintained on site by the fire crew and returned after de-mobilization to Marblemount.
- Use established latrines where provided.

- In small camp situations (1 crew), individuals should use the cat-hole method of disposing of human waste. Toilet seats should be located a minimum of 200 feet from water sources. Holes should be dug 6-8 inches deep.

Cooking and Food storage

- Use of food canisters is encouraged. They may be available through the Wilderness Information Center and at the Fire Cache.
- Store food properly so that it is not accessible to wildlife. Always hang food in trees at least 15 feet off the ground and 5 feet from the trunk of the tree, or preferably, store food in animal-resistant containers. Store food away from the campsite (100 feet or more, preferably in or near the kitchen area) to reduce the risk of human and bear conflicts and habituation of wildlife to humans.
- Animal-resistant containers should be at minimum on the "approved" list provided by the Sierra Interagency Black Bear Working Group (http://www.sierrawildbear.gov). The exception in the Complex is that Knaack boxes are approved for use as long as they are properly latched at all times they are not in use, and the locking flight-ready drums provided at the Fire Cache may also be used.
- Hang or store garbage in the animal resistant containers. Do not let garbage and food scraps accumulate in camp. All garbage and food scraps need to be removed from the camp on a regular basis if the camp is being served by a helicopter, or properly stored.
- Cooking and food storage areas will be separated from sleeping areas by at least 100 feet.
- Food will not be permitted in sleeping areas.
- Food will not be cooked over campfires.

Campfires

- Use of fires in camp will follow established Complex regulations for recreational fires (see Backcountry and Wilderness Use Regulations); if a camp is located within a fire-allowed camp, (with a designated fire pit with grate) the use of a 24-hour on-going fire is prohibited.
- Use stoves for cooking.
- Campfires should never be used for warmth in subalpine/alpine areas.
- Use dead and down firewood. Avoid cutting firewood and choose firewood that can be carried by hand and broken. Use small diameter wood that burns down more cleanly.
- Do not burn garbage or food - pack it out with the rest of the camp garbage.

Helispot Construction

- Whenever possible, the Resource Advisor should help select a helispot location, observe the construction (tree, plant, rock removal), and monitor its long-term use in order to prevent or reduce impacts to wilderness character.
- Natural helispots (openings) will be considered first before using a helispot requiring alteration.
- Whenever possible, locate helibases in weed free areas to prevent the transport of noxious weeds into wilderness.
- When planning for helispots, determine the primary function of each helispot; i.e., crew shuttle, logistical support, or both.
- If a helispot is needed only for logistical support to deliver and retrieve supplies or gear, consider using a long line remote hook in lieu of constructing a helispot.
- If a helispot is needed for crew shuttle, consider the minimum size helicopter that could do the job, if you have an option, and still meet suppression objectives.

- If some tree falling or cribbing is necessary, avoid high visitor use locations unless the modifications can be rehabilitated to be generally unnoticeable. Feather the opening so that it appears more natural looking.
- Perform an aerial reconnaissance of the fire area and select potential helispots. In determining helispot locations, involve, at a minimum, the Air Operations Manager, responsible land manager or Resource Advisor, and the Helitack Foreman. Consider drawing a sketch and discuss which trees need to be cut to ensure a safe operation for the size of the helicopter deemed necessary or available.
- If a high level of resource impact is anticipated from a proposed helispot, evaluate carefully whether it is absolutely necessary and if there isn't an alternative outside of wilderness.

Helicopter Flight Time and Landings

- Minimize flight time by using alternate means and combining trips whenever possible.
- Minimize landings; especially when any alteration of the site is required to allow safe landing; i.e., consider the use of remote hook and net before requiring a landing.
- Avoid landing on fragile subalpine/alpine vegetation or biological soil crusts.

Fire Lining Phase

- Select procedures, tools, and equipment that least impact the environment.
- Give serious consideration to the use of water as a fire lining tactic.
- If there is a risk that hose coming directly from a local unit's cache is contaminated with noxious weed seeds, order fresh hose from the regional cache.
- Resource Advisors, Operations Chief, and Logistics Chief should be cognizant of any equipment that is being moved from a non-wilderness fire to a wilderness fire and make attempts to clean equipment of noxious weed seeds prior to it being used in the wilderness.
- In light fuels consider:
  - Cold-trail line. Constantly recheck.
  - Allowing fire to burn to natural barriers.
  - Use “burn out” as a tactic to reduce the necessity for mop-up.
  - If constructed fire line is necessary, use minimum width and depth to check fire spread.
- In medium and heavy fuels consider:
  - Use of natural barriers and cold-trailing.
  - Cooling with dirt and water and cold-trailing.
  - If constructed fire line is necessary, use minimum width and depth to check fire spread.
  - Minimize bucking to establish fire line. Preferably move or roll material out of the intended constructed fire line area. If moving or rolling is not possible, or the down log is already on fire, build line around the log and let it be consumed.
- In aerial fuels, brush, trees, and snags:
  - Minimize cutting of trees and snags.
  - Live trees should not be cut unless it is determined they will cause fire spread across the fire line or seriously endanger workers. If tree cutting occurs, cut the stumps flush with the ground and camouflage the cut surface with soil or brush.
  - Scrape around tree bases near fire line if hot and likely to cause fire spread.
  - Identify hazard trees with an observer, flagging, and/or glow-sticks.
- When using indirect attack:
  - Do not fall snags outside the constructed fire line, unless they are an obvious safety hazard to crews working in the vicinity.
  - On the intended burn-out side of the line, fall only those snags that would reach the fire line should they burn and fall over. Consider alternative means to falling; i.e., fire line explosives or bucket drops.

- Review consideration listed above for aerial fuels, brush, trees, and snags.

Other Tools

- Use of water pumps and generators: Minimize because of the noise and the use of mechanical devices in wilderness. Use a water pump when it will help to avoid digging line and/or cutting trees.

Mop-up Phase

- Use gravity socks in streams and/or a combination of water blivits and fold-a-tanks to minimize impacts to streams.
- Do not bring in any non-native materials to be used for sediment traps in streams. Use of non-native materials creates a risk that noxious weeds will be introduced to the area.
- Place absorbent cloth under pumps to avoid spilling fuel on the ground.
- Personnel should avoid using rehabilitated fire lines as travel corridors whenever possible because of potential soil compaction and possible detrimental impacts to rehab work; i.e., water bars.
- Consider using infrared detection devices along perimeter (aerial or hand-held).
- Align saw cuts to minimize visual impacts from more heavily traveled corridors. Slope cut away from line of sight when possible.
- In light fuels:
  - Cold-trail areas adjacent to unburned fuels.
  - Do minimal spading; restrict spading to hot areas near fire line only.
  - Use extensive cold-trailing to detect hot areas.
- Medium to heavy fuels:
  - Cold-trail charred logs near fire line; do minimal scraping or tool scarring.
  - Minimize bucking of logs to check for hot spots or to extinguish fire; preferably roll the logs and extinguish the fire.
  - Return logs to original position after checking or when ground is cool.
  - Refrain from making bone piles; burned and partially burned fuels that were moved should be arranged in natural position as much as possible after they are cold.
  - Consider allowing larger logs near the fire line to burn out, instead of bucking them into manageable lengths. Use a lever or pry bar to move large logs.
- Aerial fuels, brush, small trees, and limbs:
  - Remove or limb only those fuels which, if ignited, have the potential to spread fire outside the fire line.
- Burning trees and snags:
  - First consideration is to allow burning trees or snags to burn themselves out or down. Ensure adequate safety measures are communicated.
  - Identify hazard trees with an observer, flagging, and/or glow-sticks.
  - If burning trees/snags pose serious threat of spreading fire brands, consider attempting to extinguish fire with water or dirt. Falling by chainsaw should be the last means; consider falling by blasting, if available.
- Mop-up of prescribed fires will occur mostly at the fire's immediate edge, allowing the interior of the unit to burn out naturally.
- Utilize fire-ending events (rain or snow) when possible to end prescribed fires in order to reduce or eliminate the need to mop-up, patrol, and monitor the burn for escape after cool down.

Structures and Installations

- Installation of RAWS (Remote Automated Weather Stations): use when necessary to minimize suppression activities and properly manage WFU, prescribed burns, and re-ignitions. Installation should be without ground or vegetation alteration.
- Installation of webcams: only use to reduce the need for helicopter flights to observe the fire.
- Installation of radio repeaters: use if needed to ensure firefighter safety. Installation should be without alteration of ground or vegetation.
- Marking fire effects monitoring plots: use the decision tree developed by the Wilderness Committee for approval. This requires approval from the Wilderness Committee and the Superintendent.

Appendix I – AIR QUALITY MODELING

Fuel Loading Inputs:
All of the fuel loadings with the exception of the FMH post-thin are provided in FOFEM according to SAF (Society of American Foresters) vegetation types. The SAF vegetation types were assigned to the project areas and covertypes of the Complex according to best estimation. The fuel loadings for the Stehekin FFRAs are based upon post-thin fuel loading data collected on fire effects monitoring plots (FMH post-thin). The table below lists the fuel loadings in tons/acre for each fuel class in the project areas.

Fuel Loading Inputs (Tons/Acre)	Litter	1 hr: 0-¼"	10 hr: ¼-1"	100 hr: 1-3"	1000 hr: 3+"	Duff	Herb	Shrub	Foliage	Branch	Total
FMH post-thin	2.9	0.6	1.7	1.1	5.9	9.0	0.2	0.35	6.0	3.0	30.8
SAF 210-Interior Douglas fir (typical*)	1.2	0.23	0.67	0.8	7.0	10.0	0.2	0.35	6.0	3.0	29.5
SAF 210 – Interior Douglas fir (heavy)	1.2	0.34	1.0	1.2	14.0	15.0	0.2	0.35	6.0	3.0	42.3
SAF 210 – Interior Douglas fir (light)	0.3	0.12	0.34	0.4	3.5	5.0	0.2	0.35	6.0	3.0	19.2
SAF 229- Pacific Douglas fir (light)	0.5	0.45	1.05	1.4	25	17.5	0.2	0.35	0.0	0.0	46.5

* Selected "typical" amount of fuel loading for all fuel time-lag classes with the exception of litter which was user-defined as heavy.

FOFEM Outputs:
The FOFEM program provides the amount of fuel consumed in tons per acre, and the emission factors in pounds per acre. The table below is a listing of the outputs per fuel model in the project areas.

Fuel Model	Fuel Consumption (tons/acre)			Emission Factor (pounds/acre)						
	Flaming	Smolder-ing	Total	PM 10	PM 2.5	CH 4	CO	CO 2	NOX	SO2
FMH post-thin	5.09	7.22	12.31	417	353	207	4,426	35,839	33	24
SAF 210- Interior Douglas fir typical	1.64	7.92	9.56	433	368	221	4,802	25,298	11	19
SAF 210- Interior Douglas fir heavy	1.64	14.34	15.98	776	658	398	8,674	41,056	11	32
SAF 210- Interior Douglas fir light	0.41	3.78	4.19	205	173	105	2,289	10,753	3	9
SAF 229- Pacific Douglas fir light	0.98	21.5	22.48	1155	979	594	12,990	56,323	6	45

The four tables below display the number of acres proposed for treatment in each alternative, the median fuel model assigned, season, moisture regime and total tons consumed. The total tons consumed are the total tons per acre of fuel listed above multiplied by the number of acres proposed for treatment. If the total tons consumed is less than 100 tons, the project does not require approval from the DNR (All of the projects proposed in each alternative will require approval from the DNR because each unit will consume more than 100 tons).

Alternative 1: Total tons of fuel consumed

Stehekin FFRA	Acres	Median Fuel Model	Season	Moisture Regime	Total tons Consumed
Orchard/Rainbow	120	FMH post-thin	Spring	Moderate	1,477.2
Boulder Creek	132	FMH post-thin	Spring	Moderate	1,624.9
Company Creek	138	FMH post-thin	Spring	Moderate	1,698.8
Coon Run	180	FMH post-thin	Spring	Moderate	2,215.8
McGregor	200	FMH post-thin	Spring	Moderate	2,462.0
Weaver Point	52	SAF 210- Interior Douglas fir (typical)	Spring	Moderate	497.1
Totals	**822**				**9,975.8**

Alternative 2: Total tons of fuel consumed

Stehekin FFRA	Acres	Median Fuel Model	Season	Moisture Regime	Total tons Consumed
Orchard/Rainbow	128	FMH post-thin	Spring	Moderate	1,575.7
Boulder Creek	147	FMH post-thin	Spring	Moderate	1,809.6
Company Creek	157	FMH post-thin	Spring	Moderate	1,932.7
Coon Run	201	FMH post-thin	Spring	Moderate	2,474.3
McGregor	200	FMH post-thin	Spring	Moderate	2,462.0
Weaver Point	54	SAF 210- Interior Douglas fir (typical)	Spring	Moderate	516.2
Harlequin	51	SAF 210- Interior Douglas fir (heavy)	Spring	Moderate	815.0
Lower McGregor	133	SAF 210- Interior Douglas fir (typical)	Spring	Moderate	1,271.5
Lower Field (Upper McGregor)	138	SAF 210- Interior Douglas fir (typical)	Spring	Moderate	1,319.3
Totals	**1,209**				**14,176.3**

Alternative 3: Total tons of fuel consumed

Stehekin Contours	Acres	Median Fuel Model	Season	Moisture Regime	Total tons consumed
Courtney	375	SAF 210- Interior Douglas fir (light)	Fall	Moderate	1,571.3
Coon Lake	564	SAF 210- Interior Douglas fir (typical)	Fall	Moderate	5,391.8
Lower Field	295	SAF 210- Interior Douglas fir (light)	Fall	Moderate	1,236.1
Wilsey	153	SAF 210- Interior Douglas fir (typical)	Fall	Moderate	1,462.7
Upper Rainbow	604	SAF 210- Interior Douglas fir (typical)	Fall	Moderate	5,774.2
Upper Boulder	309	SAF 210- Interior Douglas fir (typical)	Fall	Moderate	2,954.0
Buellers	635	SAF 210- Interior Douglas fir (light)	Fall	Moderate	2,660.7
Imus Creek	268	SAF 210- Interior Douglas fir (typical)	Fall	Moderate	2,562.1
Hazard Creek	888	SAF 210- Interior Douglas fir (typical)	Fall	Moderate	8,489.3
Maxwell	393	SAF 210- Interior Douglas fir (typical)	Fall	Moderate	3,757.1
Flick Creek	363	SAF 210- Interior Douglas fir (typical)	Fall	Moderate	3,470.3
Totals	**4,848**				**39,329.6**

Hozomeen Contours	Acres	Median Fuel Model	Season	Moisture Regime	Total tons Consumed
Little Jackass Mtn	2,180	SAF 229-Pacific Douglas fir (light)	Fall	Moderate	49,006.4
Lightning Creek	3,039	SAF 210- Interior Douglas fir (typical)	Fall	Moderate	29,052.8
Totals	**5,219**				**78,059.2**

Wildland Fire Use: Fuel Consumption and Emissions

A similar analysis was performed to determine the total tons that could potentially be consumed by wildland fire use per year. The first two tables below display the fuel loadings that were assigned to each covertype and the FOFEM fuel consumption and emissions output.

Fuel Loading Inputs (Tons/Acre)	Litter	1 hr: 0-1/4"	10 hr: ¼-1"	100 hr: 1-3"	1000 hr: 3+"	Duff	Herb	Shrub	Foliage	Branch	Total
SRM 216- Montane Meadow	0.0	0.0	0.0	0.0	0.0	0.0	1.25	0.0	0.0	0.0	1.25
SRM 209-Montane Shrubland	0.5	0.0	0.0	0.0	0.0	2.0	0.1	10.0	0.0	0.0	12.6
SAF 210-Interior Douglas fir (typical)	0.6	0.23	0.67	0.8	7.0	10.0	0.2	0.35	6.0	3.0	28.9
SAF 229- Pacific Douglas fir (light)	0.5	0.45	1.05	1.4	25	17.5	0.2	0.35	0.0	0.0	46.5
SAF 230-Douglas fir – Western hemlock	1.0	0.9	2.1	2.8	50	35	0.2	0.35	0.0	0.0	92.4
SAF 224- Western hemlock	1.0	0.9	2.1	2.8	50	35	0.2	0.35	0.0	0.0	92.4
SAF 226 – Coastal true fir - Hemlock	1.0	0.9	2.1	2.8	50	35	0.2	0.35	0.0	0.0	92.4
SAF 206- Engelmann Spruce – Subalpine fir	0.6	0.2	0.7	1.1	20	30	0.2	0.20	6.0	3.9	62.9
SAF 218 – Lodgepole pine	0.6	0.2	0.7	0.6	15	15	0.2	0.25	6.0	4.8	43.4
SAF 221 – Red Alder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAF 205- Mountain hemlock	1.9	1.0	1.1	0.8	0.8	48.6	0.3	0.2	0.0	0.0	54.7

Fuel Model	Fuel Consumption (tons/acre)			Emission Factor (pounds/acre)						
	Flaming	Smolder-ing	Total	PM 10	PM 2.5	CH 4	CO	CO 2	NOX	SO2
SRM 216 – Montane Meadow	1.25	0.00	1.25	8	7	2	16	4,446	8	3
SRM 209-Montane Shrubland	6.60	0.57	7.17	71	60	27	428	24,867	42	14
SAF 210- Interior Douglas fir typical	1.12	10.2	11.32	552	468	283	6,174	29,042	7	22
SAF 229- Pacific Douglas fir light	1.35	27.16	28.51	1,460	1,237	749	16,411	71,529	9	57
SAF 230-Douglas fir – Western hemlock	4.54	62.93	67.46	3,392	2,874	1,739	38,040	170,730	29	135
SAF 224- Western hemlock	3.73	53.56	57.30	2,886	2,445	1,480	32,379	144,880	24	114
SAF 226 – Coastal true fir - Hemlock	3.73	53.56	57.30	2,886	2,445	1,480	32,379	144,880	24	114
SAF 206- Engelmann Spruce – Subalpine fir	0.94	27.37	28.30	1,469	1,245	754	16,530	70,566	6	57
SAF 218 – Lodgepole pine	1.06	17.69	18.74	951	807	489	10,689	47,213	7	37
SAF 221 – Red Alder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAF 205- Mountain hemlock	3.34	27.44	30.77	1,488	1,260	760	16,606	79,274	21	62

The potential number of total tons consumed through wildland fire use (WFU) and suppression fires is an approximation based upon the annual estimate that 200 acres and 260 acres of land could burn in WFU and suppression fire, respectively. The relative percentage of acres that each covertype contributes to the total vegetative cover is multiplied by the total number of acres potentially consumed (e.g., subalpine meadows have a relative cover of 9.6 %, and thus 19.2 acres (.096 x 200 acres) is estimated to potentially burn in WFU). The number of acres potentially consumed is multiplied by the total fuel consumption in tons per acre that is listed above for each covertype. The total tons potentially consumed by wildland fire use and suppression are 7,133 tons and 9,246.8 tons respectively. Although this methodology is only an approximation, it does provide a comparison between tons consumed during wildland fire and during prescribed fire.

Covertype	**Median Fuel Model**	**Season**	**Moisture Regime**	**Relative % total Acres**	**Total tons Consumed**	
					WFU	**Suppression**
Subalpine meadow	SRM 216 – Montane Meadow	Summer	Wet	9.6	24	31.2
Shrubland	SRM 209-Montane Shrubland	Summer	Moderate	6.8	97.5	126.8
Douglas fir / Ponderosa pine	SAF 210- Interior Douglas fir typical	Summer	Dry	7.8*	176.6	229.6
Douglas fir / Lodgepole pine	SAF 229- Pacific Douglas fir light	Summer	Dry	7.7*	439.1	570.8
Douglas fir / Western hemlock	SAF 230-Douglas fir – Western hemlock	Summer	Dry	7.8*	1,052.4	1,368.1
Western hemlock	SAF 224- Western hemlock	Summer	Moderate	15.1	1,730.5	2,249.6
Pacific Silver fir	SAF 226 – Coastal true fir - Hemlock	Summer	Moderate	17.8	2,039.9	2,651.8
Subalpine fir	SAF 206- Engelmann Spruce – Subalpine fir	Summer	Moderate	2.7	152.8	198.7
Lodgepole	SAF 218 – Lodgepole pine	Summer	Dry	1.4	52.5	68.2
Hardwood	SAF 221 – Red Alder	Summer	Moderate	1.4	0.0	0.0
Mountain hemlock	SAF 205- Mountain hemlock	Summer	Moderate	21.9	1,347.7	1,752.0
Totals					**7,113.0**	**9,246.8**

*****The relative percentage of total acres of the Douglas fir covertype was distributed evenly between the three vegetation types (Douglas fir / Ponderosa pine, Douglas fir / Lodgepole pine, and Douglas fir / Western hemlock) because there is no data on their individual covers.