Response to MVCC's "Treatment Monitoring Report"

Mission Restoration Project

January 10, 2023

Introduction

The Forest Service received a copy of the "Treatment Monitoring Report" (Report) of the Mission Restoration Project completed by the Methow Valley Citizen's Council (MVCC) on November 2, 2022.

We appreciate the effort MVCC took to evaluate and quantify treatment outcomes on several implemented units within the Mission Restoration Project to substantiate their concerns about the implementation of the project. As the Forest Service works to expand the pace and scale of forest restoration across the Okanogan-Wenatchee National Forest, we recognize that a key element in restoring ecological function and maintaining resilience in a changing environment is the **quality** of these restoration efforts. The Mission Restoration Project and the concerns raised by MVCC in Report give us the opportunity to collaboratively engage in learning and assessment and ensure that the quality of restoration treatments is continuously improved as we implement larger and more complex projects in the future. The Report highlights an opportunity for partners to work with the Forest Service to develop **consistent, repeatable, and rigorous monitoring** that is mutually agreed upon to assess outcomes and ensure contract specification and prescription targets are being met.

We will address the issues raised in the Report as they pertain to the Mission Restoration Project's silvicultural objectives, prescriptions, parameters[1], and operational results, aiming to create a common understanding and shared dialog about how these issues can be improved in future project planning and implementation. We trust that continued conversations will result in outcomes that meet the multiple ecological, social, and economic objectives of our project plans.

Issues and Reponses

Issue 1

The Mission DxP (designation by prescription) contract specifies fewer residual trees per acre (TPA) than the Mission Restoration Environmental Assessment (EA) and is therefore inconsistent with the EA (Treatment Monitoring Report, pp. 2, 4-5).

Response 1

Upon review, we believe that Mission DxP contract specifications meet the standards for residual trees per acre listed in the EA. The EA lists silvicultural prescriptions by unit type and identifies treatment parameters to be applied during commercial thinning. The EA states (EA, p. 337-344) that to meet the purpose and need of the project, more than one treatment parameter would be applied to an individual unit where needed to meet landscape objectives. The prescriptions are intended to work together to achieve the desired future condition.

[1] Objective = a landscape goal
Prescription = the method for cumulative treatment of the landscape
Parameter = the specific, often minute, details to fulfill a prescription for different stand types during commercial thinning

The EA's general commercial thinning objectives include reducing dwarf mistletoe infection, reducing the encroachment of conifers into aspen stands, and retaining the largest and most vigorous preferred coniferous species (EA, p. 140). Notably, the second general thinning parameter states "target numbers and preferred species of leave trees would be applied to site conditions within the harvest unit, would vary based on available merchantable timber volume and plant association group and *would be reduced based on root disease and the presence of dwarf mistletoe (emphasis added)"* (EA, p. 140). The full text of parameters from the EA are included as Appendix A.

The EA applies these treatment parameters to all commercial thinning prescriptions (Aspen Release, Dry Forest Restoration Thin (DFR), Dry Forest Restoration Thin with Dwarf Mistletoe Reduction (DFDMT), and Moist Forest Thin (MFT)). For example:

- The Aspen Release prescription states that "conifer stands…which are located outside of aspen clones and more than 50' away from aspen clone perimeters would be treated with the DFR or DFDMT harvest treatments…*depending on existing stand conditions (EA, p. 341).*"
- The DFDMT prescription states that the "removal of suppressed, diseased, or dwarf mistletoe susceptible trees may result in post-harvest conifer stocking levels up to approximately 25% less than the respective *DFR desired residual tree stocking numbers displayed above" (EA, pp. 342-344).*
- The residual TPA within the DFR units would be reduced based on root disease and the presence of dwarf mistletoe. This TPA reduction is possible because the DFR and DFDMT prescriptions work to support each other (EA, pp. 341-342).

Though the prescriptions "Aspen Release" and "DFDMT" will apply in their entirety to specific units, they are also intended to apply to DFR units throughout the project area to meet silvicultural objectives (EA, p. 339-344). Not every acre of every DFR unit was intended to receive reductions for root disease, mistletoe infections, or aspen release, but reductions were intended to be applied where it makes sense silviculturally to meet stand health, composition, and resilience objectives. Ultimately, forest structure and stand health at the time of treatment will determine how treatments are implemented on the landscape.

Issue 2
The implementation of the Mission DxP contract fails to leave the required number of trees per acre listed in the EA (Treatment Monitoring Report, pp. 4-5, Table 1).

Response 2
The response to Issue 1 establishes that the residual trees per acre will vary by the existing silvicultural conditions in a unit. Forest Service staff monitor harvest activities and operations and conduct regular, often daily, inspections. Monitoring plots are installed every 20 acres by the Contractor and verified by the Forest Service to ensure silvicultural compliance across different prescriptions. To date, the contractor has been in full compliance with all contract specifications.

After receiving MVCC's Report, Forest Service staff attempted to replicate the sampling method presented. Staff were unable to replicate the sampling methodology because of inconsistencies

between spatial and ground monumentation, boundary discrepancies, and missed "count" trees within plots. Because Forest Service staff were unable to replicate the Report's methods, we developed a statistically valid sampling design (Forest Mensuration, Husch, Miller, Beers, pp. 200-228) to check the Report's findings. The design for this "confirmation" monitoring installed plot grids on units using ArcGIS Pro Fishnet analysis tools (see maps). This method identified sampling locations at a frequency of one plot approximately every four acres; staff collected data using 1/10- and ¼-acre nested plots at these locations.

This "confirmation" monitoring, along with ongoing "implementation" monitoring that is required and administered as part of the contract indicated that each of the sampled units within the MVCC Report were within the desired TPA range specified with the Mission Restoration Project EA after accounting for potential mistletoe impacts on residual TPA. The table below compares the results from the Report, the Forest Service's "confirmation" sample plots, and the Forest Service's on-going implementation monitoring.

The difference in results due to sampling methods highlights the importance of working collaboratively with our partners to develop a rigorous, consistent, and repeatable monitoring approach for this and other projects in the Okanogan-Wenatchee National Forest. Having a mutually sanctioned monitoring program would ensure that ecological, social, and economic outcomes are met. It is vitally important that we be on the same page if we are to successfully reduce the threat of high-intensity wildfire at a landscape scale.

Comparison of Sampling Results from MVCC Treatment Report, Random Samples, and On-going Implementation Monitoring

Subdivision (acres)	**Residual TPA goal from EA** **[Unit Type / Silvicultural Prescription from EA]**	**Treatment Monitoring Independent Report (TPA)** **[Plot(s) Used]**	**Forest Service Confirmation Plots (TPA)** **[Plot(s) Used]**	**FS Implementation Monitoring (TPA)** **[Plot(s) Used]**
Sub 2 (48)	23 to 30 [Warm Dry DFR: 30-40 TPA reduced 25% to 23-30 TPA due to DFMT]	18 [1 plot of 3 acres]	24 [9 plots, 1/10th & ¼-acres nested]	25.3 [12 fixed ¼ acre plots]
Sub 4 (26)	15 to 23 [DFDMT 20-30 TPA reduced 25% to 15-23 TPA]	17 [1 plot of 3 acres]	17 [7 plots, 1/10th & 1/4 nested]	23 [10 fixed ¼ acre plots]
Sub 6 (40)	23 to 30 [Warm Dry DFR: 30-40 TPA reduced 25% to 23-30 TPA due to DFMT]	17 [1 plot of 3 acres]	23 [9 plots, 1/10th & 1/4 nested]	26 [10 fixed ¼ acres plots]
Sub 20 (12)	15 to 23	12 [1 plot of 3 acres]	20	22

Subdivision (acres)	Residual TPA goal from EA [Unit Type / Silvicultural Prescription from EA]	Treatment Monitoring Independent Report (TPA) [Plot(s) Used]	Forest Service Confirmation Plots (TPA) [Plot(s) Used]	FS Implementation Monitoring (TPA) [Plot(s) Used]
	[DFDMT 20-30 TPA reduced 25% to 15-23 TPA]		[5 plots, 1/10th & 1/4 nested]	[4 fixed ¼ acre plots]
Sub 211 (23)	15 to 23 [DFDMT 20-30 TPA reduced 25% to 15-23 TPA]	13 [1 plot of 3 acres]	15 [6 plots, 1/10th & 1/4 nested]	15 [8 fixed ¼ acre plots]

Issue 3

Post-harvest spatial patterns do not reflect the specifications in the EA for ICO (individuals / clumps / openings) (Treatment Monitoring Report, pp. 2, 4-5, Table 1).

Response 3

The EA discusses ICO in detail, and we acknowledge that these treatment objectives were not sufficiently carried forward into the Mission DxP contract. The contract focused on the silvicultural priorities of raising the canopy height, reducing stocking levels, and selecting for the healthiest residual cohort with the goal of returning the *landscape* to a healthy, fire-resilient state. Individuals, small and large clumps, and openings should exist in all harvested subdivisions; however, we agree that their relative abundance and distribution can be improved. Up to this point, the poor health of existing cohorts has made it difficult to ensure that clumps and openings resemble historic patterns while also achieving fuels reduction goals.

The MVCC Report made observations about residual spatial patterns in five of the Mission Restoration Project units. These observations highlight that explicit and thoughtful contract language is needed to ensure that contractors can implement specific spatial patterns at the stand scale. The Forest Service looks forward to working with partners like MVCC to improve the implementation of ICO spatial patterns in upcoming harvest units. Our goal is to arrive at mutually acceptable prescriptions and contract language that incorporates ICO objectives.

Issue 4

Larger trees were not clearly favored (Treatment Monitoring Report, p. 2).

Response 4

For various reasons during harvest operations, large trees (trees greater than 21" and less than 24" DBH) are sometimes chosen for removal over smaller ones. For example, large, healthy ponderosa pine are preferred as leave trees over Douglas-fir. If a large, compromised Douglas-fir is directly competing with a healthy, dominant ponderosa pine or healthy, codominant Douglas-fir, the large, compromised Douglas-fir will be removed to favor the dominant ponderosa pine or smaller Douglas-fir. This treatment, though removing a larger (diseased) tree, is considered a net benefit to stand health into future decades.

Although we did not capture large tree retention within our survey data, large Douglas-fir and ponderosa pine are found throughout the project area. All trees greater than 24" DBH are retained regardless of health and vigor. Given the social and ecological value of large trees, we welcome partner

collaboration in thinking through an approach that would allow us to better track the retention of these trees in treatments as part of our larger restoration strategy on the Okanogan-Wenatchee National Forest.

Conclusion

The MVCC's "Treatment Monitoring Report" – beyond the issues it raises – illustrates the need for a **consistent, repeatable, and rigorous monitoring program that is mutually agreed upon between the partners and the Forest Service.** We suggest this could be achieved with the recently funded North Central Washington Collaborative Forest Landscape Restoration Project (CFLRP), or through the North Central Washington Forest Health Collaborative's third-party monitoring subcommittee. The Forest has a unique opportunity afforded the CFLRP to adopt and widely implement consistent and repeatable monitoring methods to address a range of partner interests. We invite MVCC and other interested partners to take part in the ongoing conversations to develop a 10-year CFLRP monitoring plan. Having a shared monitoring approach would prevent the time, trouble, and miscommunication that would prevent us all from meeting our objective of a healthy forested landscape resilient to high-intensity wildfire.

In summary, the Mission Restoration Decision Notice (DN) has several purposes and needs, one being to "maintain and restore forest vegetation characteristics to within estimated historical and future ranges of variability to improve forest resiliency to insect, disease, and wildfire events" (DN, p. 5). Historically, the forest stands in the Mission Restoration Project would have been much more open, but a legacy of past management practices combined with a century of fire suppression has resulted in a current landscape with much less resiliency to wildfire, insects, and disease (DN, p.5, last bullet). The silvicultural prescriptions in the EA are intended to work in concert to achieve lower densities and open canopies for more resilient conditions across this landscape. For context, the selected alternative (Modified Alternative 2) proposes to treat about 20 percent of the 50,200-acre landscape analyzed (Appendix A, attached). Commercial harvest accounts for only 2 percent (~1,800 acres) of the treatment area.

We highly value our community and cannot understate the role of our engaged partners in ensuring the success of landscape restoration projects across the Okanogan-Wenatchee National Forest. We look forward to continuing to productively engage with MVCC and our other partners to increase the pace, scale, and **quality** of forest restoration work on the Methow Valley Ranger District and Forest more broadly. We encourage anyone with questions to reach out to the Methow Valley Ranger District.

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Approved by: Julie Bain (District Ranger, Acting)

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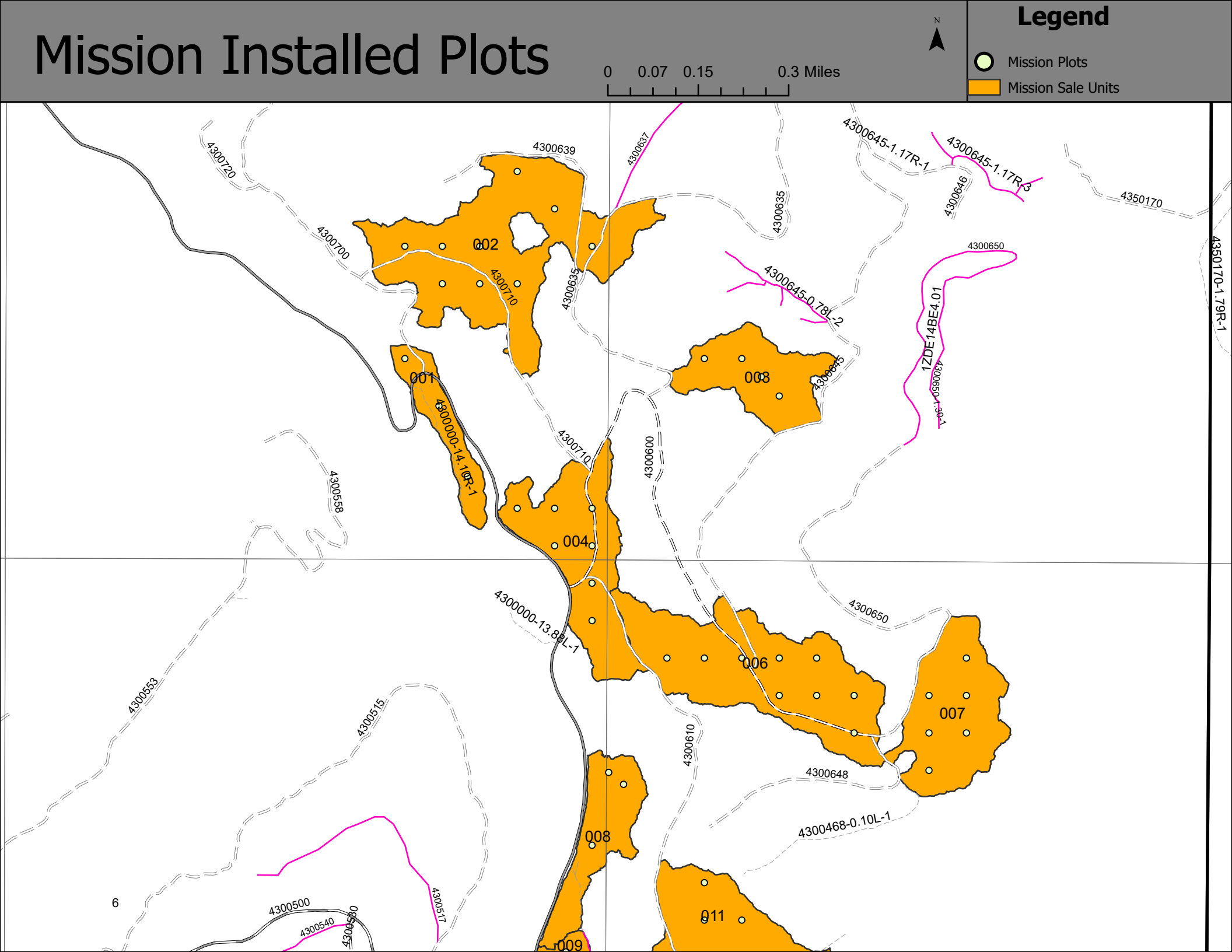
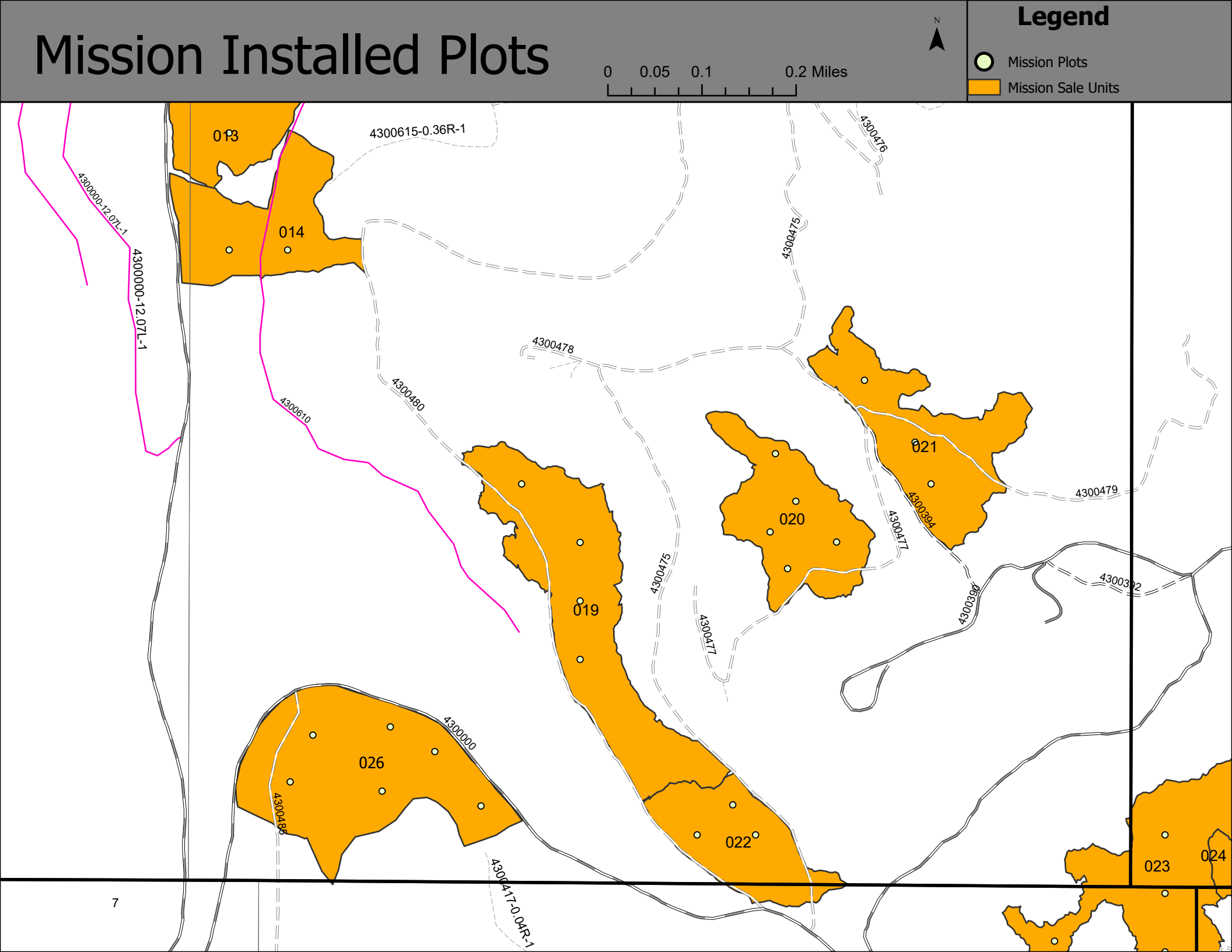
Mission Installed Plots



Mission Installed Plots



Appendix A: Proposed Thinning and Prescribed Fire Treatments

This appendix contains parameters and prescriptions applicable to proposed commercial and non-commercial thinning treatments and prescribed fire treatments in the Mission Restoration project area. Proposed thinning and prescribed fire treatment units are displayed in Appendix F. Figure 139 lists the thinning prescription names in alphabetical order, summarizing the thinning and prescribed fire treatments and their relationship to the project's purpose and needs. A more detailed description of each thinning prescription follows.

Figure 139. Mission Thinning and Prescribed Fire Prescription Summary

Thinning Prescription	Thinning Prescription Summary	Prescribed Fire Prescription[1]	Total Acres	Purpose
Aspen Release Thin (ASPEN) (commercial)	Thin conifers up to 24" DBH with mechanized equipment. Thin remaining trees ≤8" DBH with chainsaws. Prune remaining conifers up to 6'	MP: 0 ac UB: 135 ac HP: 25 ac Landings: 16	160 ac	P&N#3: Vegetation Composition & Structure P&N #5: Sensitive Plants & Unique Habitats. • Release aspen from conifer encroachment. • Stimulate & diversify development of aspen.
Conifer Girdling for Aspen Restoration (CGAR) (Noncommercial)	Thin conifers ≤10" DBH in 15 – 30' circles around aspen trees with chainsaw. Girdle conifers 10 – 21" DBH with chainsaws.	HP: 47 ac UB: 24 ac	71 ac	P&N #5: Sensitive Plants & Unique habitats • Release aspen from conifer encroachment. • Stimulate & diversify development of aspen.
Dry Forest Restoration Thin (DFR) (commercial)	Thin conifers up to 24 " DBH with mechanized equipment. Thin remaining trees ≤8" DBH with chainsaws. Prune remaining conifers up to 6'.	MP: 463 ac UB: 817 ac Landings: 128	1280 ac	P&N #1: Hydrologic and Aquatic Restoration P&N #3: Vegetation Composition & Structure P&N #4: Wildlife Habitat P&N#6: Wildfire Hazard in WUI • Restore structure, composition, and pattern of conifers in frequent fire interval forests. Accelerate growth of and protection of larger trees. Increase stream flow.

Thinning Prescription	Thinning Prescription Summary	Prescribed Fire Prescription[1]	Total Acres	Purpose
Dry Forest Restoration – Dwarf Mistletoe Thin (DFDMT) (commercial)	Thin conifers up to 24" DBH with mechanized equipment. Thin remaining trees ≤8" DBH with chainsaws. Prune remaining conifers up to 6'.	MP: 87 ac UB: 197 ac Landings: 28	284 ac	P&N #3: Vegetation Composition & Structure. • Restore structure, composition, and pattern of conifers in frequent fire interval forests. Reduce Douglas-fir dwarf mistletoe infection. Accelerate growth of and protection of large trees.
Ladder Fuel Reduction Thin (LFR) (Noncommercial)	Thin conifers ≤ 8" DBH with chainsaws. Thinning would occur in 15 – 30' circles around trees >8" DBH. Prune remaining conifers up to 6'. No felling of trees within IRA (see figure 121).	HP: 1154 ac UB: 5346 ac	6500 ac. outside of commercial thin units	P&N #3: Vegetation Composition & Structure P&N #4: Wildlife Habitat P&N #6: Wildfire Hazard in WUI • Restore stand structure, composition, and pattern in frequent-fire return interval forests. • Accelerate growth of and protect larger trees. • Reduce risk of crown fire initiation. • Increase public/firefighter safety and suppression options.
Moist Forest Thin (MFT) (commercial)	Thin conifers up to 24" DBH with mechanized equipment. Thin remaining trees ≤ 8" DBH with chainsaws. Prune remaining conifers up to 6'.	MP: 67 ac UB: 3 ac Landings: 7	70 ac	P&N #3: Vegetation Composition & Structure (Units 26 & 27 = 36 acres) P&N #4: Wildlife Habitat (Units 1 & 65 = 34 acres) • Maintain large trees and structural diversity. Accelerate development of large trees in dense multi-story (NSO) habitat. Reduce risk of crown fire initiation in NSO habitat.
Plantation Thin (TSI) (Noncommercial)	Thin conifers up to 8" DBH[4] with a chainsaw. Prune remaining conifers up to 6'	HP: 1653 ac HP & UB: 660 ac MP & UB: 85 ac	1738 ac	P&N #3: Vegetation Composition & Structure; P&N #4: Wildlife Habitat • Reduce stand density. Accelerate growth of larger trees. (Promote early seral species while maintaining species diversity).

Thinning Prescription	Thinning Prescription Summary	Prescribed Fire Prescription[1]	Total Acres	Purpose
Post and Pole Thin (PP) (Noncommercial)	Thin conifers up to 13" DBH with chainsaws; remove trees by hand (no mechanized equipment – personal use). Thin conifers greater than 2' tall and ≤8" DBH with chainsaws. Thinning would occur in 15 – 30' circles around trees >8" DBH. Prune remaining conifers up to 6'.	UB: 36 ac	36 ac	P&N #3 Vegetation Composition & Structure
Variable Retention Regeneration (VRR) (commercial)	Harvest conifers up to 24" DBH with mechanized equipment. Fell remaining undesirable trees up to 8" DBH with whip felling. Prune remaining conifers up to 6'. Replant post-prescribed fire treatment	UB: 59 ac	59 ac	P&N #3: Vegetation Composition & structure. • Promote early seral species and regenerate a new cohort of trees in the majority of the unit while maintain components of structural diversity.
Wetland Thin (WT) (Noncommercial)	Thin conifers up to 8" DBH with chainsaws in Black Pine Meadows and Mission Pond	HP:22 ac	22 ac	P&N #4: Wildlife Habitat. P&N #5: Sensitive Plants & Unique Habitats. • Reduce conifer encroachment in wetlands.

[1] *AC = acres; HP = Hand pile and burn piles; UB = Underburn; MP = Machine pile and burn piles; DBH = Diameter at Breast Height*

Commercial Thinning Parameters and Prescriptions

General Commercial Thinning Parameters

Proposed commercial harvest treatments would follow the following parameters:

1. Conifers 7 to 9 inches DBH (merchantable diameters for Douglas-fir and ponderosa pine respectively) up to 24 inches diameter at breast height (DBH) would be harvested with the following provisions (except in Riparian reserves as noted below):
    a. All trees greater than 24 inches DBH would be retained
    b. Trees 21 inches DBH and larger with an estimated age of 150 years or greater (based on tree appearance criteria described in Van Pelt 2008) would be retained.
    c. Trees 21 to 24 inches DBH with an estimated age of less than 150 years would occasionally be harvested to release a larger (more preferred species) tree, reduce dwarf mistletoe infection, or reduce conifer encroachment in aspen stands (except in areas with field verified old forest multistory structure located in unit 21) when consistent with treatment objectives.

d. Thin conifers from below retaining trees among the largest, most vigorous, and most preferred conifer species present to meet treatment objectives.
e. Conifer species preference for retention, unless specified otherwise, is as follows in descending order: ponderosa pine, Douglas-fir, Engelmann spruce, lodgepole pine, and subalpine fir (based on fire and insect resiliency).
f. Remove all Douglas-fir, subalpine fir and Engelmann spruce less than 21 inches DBH within 50 feet of the last indication of infected trees within root disease pockets.

2. Target numbers and preferred species of leave trees would be applied to site conditions within the harvest unit and would vary based on available merchantable timber volume and plant association group and would be reduced based on root disease and dwarf mistletoe levels. Dominant prescriptions are identified in Figure 141.

3. Conifers less than merchantable diameter which exceed desired tree density levels and are not needed to meet resource management objectives also would be removed at the time of logging if favorable market conditions exist.
4. Conifers less than merchantable diameter remaining following harvest which exceed desired tree density levels and are not needed to meet resource management objectives would be felled in a ladder fuel reduction treatment (see Ladder Fuel Reduction thin description below for specifications). Conifers felled post-harvest would be made available for firewood gathering where consistent with fuels management and stand treatment objectives and the current firewood policy.
5. Harvest treatments when conducted in Riparian Reserves would occur to benefit and restore aquatic resources. Regeneration harvest would not occur in Riparian Reserves. All trees 18 inches DBH and larger would be retained in Riparian Reserves.
6. Harvest treatments in Riparian Reserves located in harvest units 53 - 57 would be conducted as follows to meet aquatic resource management objectives:
    a. Twenty to 30 conifers per acre on average would be retained in accordance with the Dry Forest Restoration Thin treatment criteria (described below) to reduce conifer competition with existing deciduous vegetation and promote the establishment of additional deciduous trees and shrubs.
    b. Harvest would occur an additional 25 feet closer to intermittent stream channels than standard harvest buffer design features described for the project. Ground based harvest equipment would be restricted from operating in the additional 25 feet wide treatment area.
    c. Riparian Reserve conifers located between intermittent streams and the boundaries of harvest units 53 - 57 would be hand-felled toward the stream to add coarse woody debris into the channel or girdled to retain an average live conifer stocking level of the largest 20 to 30 trees per acre to reduce conifer competition with existing deciduous vegetation and promote the establishment of additional deciduous trees and shrubs. No commercial harvest would occur in this zone.
7. Harvest treatments would not include the removal of snags, although some may be fell for safety reasons and left on site.

Commercial Thinning Prescriptions

Aspen Release (Aspen) (8 units/ 160 acres total)

Conifers of merchantable diameter would be harvested to release existing aspen trees from conifer encroachment and promote the establishment of aspen and other hardwood regeneration. This treatment would be applied to reduce conifer competition for sunlight and soil moisture, improve the vigor of existing aspen trees, and stimulate sprouting of new aspen stems where conifers have invaded or are shading out aspen clones.

Conifer removal for aspen release treatment would be implemented within existing aspen clones (defined as five or more healthy aspen trees greater than or equal to five feet tall located within a 15 foot radius) and a 50 foot wide buffer located adjacent to aspen clone perimeters. Desired treatment objectives include 10 percent or less canopy closure contributed by conifers following treatment within aspen stands and the adjacent buffer (Shepherd, et al. 2006; Swanson, et al. 2010). Implementation of this objective would be achieved by retaining a maximum stocking level of approximately ten merchantable sized conifers per acre following treatment within aspen stands and the buffer. Ponderosa pine is the preferred conifer species to retain within aspen stands and the adjacent buffer. Douglas-fir and subalpine fir are the least preferred conifer species to retain within aspen stands and the adjacent buffer. The largest conifers of the most preferred species present would be favored for retention. Conifers would be retained in clumps when possible to attain conifer canopy closure objectives. Live defective conifers with favorable characteristics for wildlife habitat would be retained within and adjacent to aspen stands. Douglas-fir and subalpine fir 21 to 24 inches DBH with an estimated age of less than 150 years (based on criteria described in Van Pelt 2008) would be harvested where needed to achieve desired conifer stocking levels except in areas with field verified old forest multistory structure located in unite 21. All conifers larger than 24 inches DBH and 21 to 24 inches DBH with an estimated age of 150 or more years would be retained in aspen clones and the adjacent buffers even if conifer stocking exceeds the desired maximum retention level. No aspen or other deciduous broadleaf trees would be harvested.

Conifer stands within aspen release treatment unit boundaries which are located outside of aspen clones and more than 50 feet away from aspen clone perimeters would be treated with the Dry Forest Restoration Thin (DFR) or Dry Forest Thin with Dwarf Mistletoe Reduction (DFDMT) harvest treatments, which are described below, depending on existing stand conditions.

Non-merchantable conifers remaining following harvest would be felled in aspen clones and adjacent 50 foot wide buffers to reduce competition with existing aspen stems and promote expansion of aspen clones.

Dry Forest Restoration Thin (DFR) (49 units/ 1,280 acres total)

Conifers of merchantable diameter would be harvested to maintain and restore elements of historic forest stand structures including tree density, large and old trees, species composition, and spatial patterns (including tree clumps, individual trees, and canopy openings) to increase stand and landscape resiliency to natural disturbances including forest insect attacks, tree diseases, and wildfires. Desired residual tree density, species composition, and spatial patterns within stands are derived from data collected in reference stands located in the eastern Washington Cascades (Nature Conservancy et al. 2016; Ohlson and Schellhaas. 2002; Ohlson 1996) and previously implemented projects on the Methow Valley Ranger District. This treatment would be applied primarily in densely stocked mixed conifer species or ponderosa

pine stands with single or multiple canopy layers (stem exclusion closed canopy, young forest multistory, or understory re-initiation stand structures) and sufficient numbers of healthy trees in the upper canopy layer to achieve desired density, species composition, and spatial pattern of residual trees. The majority of trees in stands with this proposed treatment are less than 150 years old and large (> 25 inches DBH) and old trees (≥ 150 years) may be nonexistent to relatively abundant. Dwarf mistletoe and root disease may be present in individual trees or small pockets and are not widespread throughout treated stands.

Figure 140 displays the desired range of post-harvest tree density levels of residual merchantable sized conifers and 5 inch DBH or larger aspen trees for proposed dry forest restoration thin harvest units. Anticipated tree mortality caused by post-harvest fuels treatments would be taken into consideration during development of timber marking guidelines to achieve desired live tree density levels. Plant association groups in the Mission analysis area are described in the *Field Guide for Forested Plant Associations of the Wenatchee National Forest* (Lillybridge, et al. 1995). Target numbers of trees to remain will vary within harvest units based on plant association group and would be reduced based on root disease and the presence of dwarf mistletoe.

Figure 140. Mission Desired Tree Stocking Levels in Dry Forest Restoration Thin Harvest Units

Plant Association Group(s)	Approximate average number of trees per acre retained
Hot-dry ponderosa pine and Douglas-fir	20 - 30
Warm-dry and warm-mesic Douglas-fir	30 - 50
Cool-dry Douglas-fir and subalpine fir	40 - 50

The desired spatial pattern or horizontal arrangement of residual trees within stands can best be described in terms of individual trees, tree clumps, and canopy openings (Churchill et al. 2014; Larson and Churchill 2012; Larson et al. 2012). A clump of trees is defined as two or more trees in close enough proximity that a portion of their crowns are interlocking. Approximately 65 percent of residual trees in dry forest restoration thin harvest units would be retained in clumps of various size with a spacing of 20 feet or less between leave tree boles. A leave tree is considered part of a clump if the bole of the tree is located 20 feet or less horizontal distance from at least one other leave tree bole. Approximately 35 percent of residual trees would be retained as individual trees located more than 20 feet away from all other leave trees. To promote an irregular distribution of residual trees, average tree stocking and clump target levels would be achieved over the entire area of a treatment unit rather than on every acre. Canopy openings would be comprised of those areas where the distance between residual tree boles is greater than 3 times the maximum “clumped” tree distance (60 feet). Canopy openings, generally expected to be one third acre in size or less, would occur on approximately 20 percent of treatment areas.

Generally, the largest and most vigorous conifers (with regard to height, bole diameter and live crown volume) of the most preferred species present in a given area would be retained to achieve the target or desired stocking levels and spatial pattern of residual trees. All trees

greater than 24 inches DBH would be retained. All trees 21 inches DBH and larger with an estimated age of 150 years or greater (based on criteria described in Van Pelt 2008) would be retained and vigorous trees would be released from competition with adjacent younger and smaller trees. Live defective trees and dying trees would be retained as needed to provide cavity dependent habitat. Complex patches which include large snags, live defective trees, large and old trees, or large dwarf mistletoe infected trees would be retained. No aspen or other deciduous broadleaf trees would be harvested. Aspen clones one quarter acre and larger in (includes adult trees and suckers) size included within dry forest restoration thin harvest units would receive the previously described Aspen Release (Aspen) harvest treatment (see Aspen Release description below for specifications). Aspen trees of at least 5 inches DBH would count towards individual and clump targets.

Dry Forest Restoration Thin with Dwarf Mistletoe Reduction (DFDMT) (10 units/ 284 acres total)

This treatment is similar to the previously described dry forest restoration thin treatment with an emphasis on reducing Douglas-fir dwarf mistletoe infection levels in treated stands. This treatment would be applied in mixed conifer species stands comprised primarily of trees less than 150 years old with sufficient healthy ponderosa pines, Douglas-firs, and other conifer species to achieve desired density levels in the majority of the stand and moderate to high levels of Douglas-fir dwarf mistletoe infection in other portions of the stand. These stands typically have multiple canopy layers including areas with densely stocked trees, openings, and widely spaced trees. Large (> 25 inches DBH) and old (≥ 150 years) Douglas-fir and ponderosa pines may be present in some stands.

The Dry Forest Restoration Thin harvest treatment would be applied throughout areas that are adequately stocked with vigorous and disease-free trees to meet density, species composition, and spatial pattern treatment objectives. Young and mature trees (with an estimated age of less than 150 years) 20 inches DBH and smaller infected with dwarf mistletoe would be harvested throughout treatment units to achieve dry forest restoration thin tree retention objectives (including heterogeneous spatial patterning of residual trees) and reduce the proportion of infected trees in treated stands. Vigorous trees with low infection levels (dwarf mistletoe infection ratings generally of 2 or less; Hawksworth 1977) would be retained where needed to achieve tree retention objectives. Infected trees 21 to 24 inches DBH with an estimated age of less than 150 years would be harvested on a case by case basis consistent with stand treatment objectives. All trees 21 inches DBH and larger with an estimated age of 150 or more years (based on criteria described in Van Pelt 2008) would be retained and vigorous trees not infected with dwarf mistletoe would be released from competition with adjacent younger trees. Aspen clones one quarter acre and larger in size included within dry forest restoration thin harvest units would receive the previously described Aspen Release (Aspen) harvest treatment.

Treatment objectives include reducing future susceptibility to Douglas-fir dwarf mistletoe infection in treated stands. This includes shifting trees species composition towards ponderosa pine and other conifer species that are not susceptible to Douglas-fir dwarf mistletoe and confining infections in residual trees where possible. Infected trees 21 inches DBH and larger would be retained as isolated individuals or discrete clumps with the removal of smaller Douglas-firs located within 50 feet to reduce the spread of dwarf mistletoe (Schmitt 1997). Removal of suppressed, diseased or dwarf mistletoe susceptible trees may result in post-harvest conifer stocking levels up to approximately 25 percent less than the respective dry forest restoration thin (DFR) desired residual tree stocking numbers displayed above. Canopy

openings larger than two acres created by harvest and post-harvest fuels treatments would be assessed to determine if reforestation with pines or other non-susceptible species is needed to meet treatment objectives.

Moist Forest Thin (MFT) (4 units/ 70 acres total)

Conifers of merchantable diameter would be harvested to maintain or promote the development of large trees and multistory stand structure in two stands totaling an estimated 38 acres (units 1 and 65) currently providing or with potential to provide northern spotted owl habitat. This treatment would be applied primarily in densely stocked mixed conifer stands with multiple canopy layers (young forest multistory stand structure) where the majority of trees are less than 150 years old and large and old trees are present in the overstory canopy layer. Treatment objectives include retaining multistory stand structure while reducing stand density to 60% or greater canopy closure with variable thinning from below to remove smaller subordinate trees which are competing with larger trees present in treated stands. All trees 18 inches DBH and larger would be retained. Areas comprised primarily of trees less than 18 inches DBH would be thinned to retain vigorous trees, reduce but not necessarily eliminate dwarf mistletoe infection, and provide growing space for residual trees to develop into larger trees. The preferred spatial pattern for tree retention would include approximately 70% or greater of trees retained in clumps of variable size comprised primarily of Douglas-firs and 30% or less individual trees. Vigorous old ponderosa pine trees 21 inches DBH and larger with an estimated age of 150 years or greater (based on criteria described in Van Pelt 2008) would be treated with release felling to remove trees less than 18 inches DBH with crowns located within the pine tree canopy dripline. Trees growing within the canopy dripline of declining pines (less than 30% live crown ratio) 21 inches DBH and larger would be retained to promote clump development around future snag recruits. Complex patches which include large snags, live defective trees, large and old trees, or large dwarf mistletoe infected trees would be retained. Canopy openings created by tree removal would be limited to one quarter acre and smaller in size.

Conifers of merchantable diameter would be harvested to reduce subalpine fir/Engelmann spruce forest cover and promote Douglas-fir and lodgepole pine forest cover in two stands totaling an estimated 37 acres (units 26 and 27). This treatment would be applied in mesic and dry mixed conifer stands stocked with subalpine fir, Engelmann spruce, Douglas-fir, and lodgepole pine trees in multiple canopy layers (young forest multistory stand structure). Portions of these stands have experienced lodgepole pine mortality caused by mountain pine beetle attacks. With the exception of subalpine fir, the largest and most vigorous conifers (with regard to height, bole diameter and live crown volume) of the most preferred species present would be retained in clumps of various sizes to achieve the target or desired residual stocking level of approximately 40 to 50 trees per acre. Tree species retention preference in descending order is Douglas-fir followed by ponderosa pine, Engelmann spruce and lodgepole pine. Standing dead and down lodgepole pines in excess of snag and large woody debris retention objectives would be removed for firewood or other forest products. All trees greater than 24 inches DBH and all trees 21 inches DBH and larger with an estimated age of 150 years or greater (based on criteria described in Van Pelt 2008) would be retained. Live defective trees and dying trees would be retained as needed to provide cavity dependent habitat. Complex patches which include large snags, live defective trees, large and old trees, or large dwarf mistletoe infected trees would be retained. No aspen or other deciduous broadleaf trees would be harvested. Aspen clones one quarter acre and larger in size included within harvest units 26