



Cretaceous Hills Ecological Restoration Project Implementation Guide



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Introduction

The Cretaceous Hills Ecological Restoration Project includes prescribed burning on about 15,000 acres; mechanical treatment of non-native pines and small hardwood trees on about 3,200 acres; treatment of invasive plant species; development of vernal ponds as upland water sources for bats and amphibians; roadwork needed to implement commercial harvesting and prescribed fire activities; and development of firelines. The selected alternative, alternative 4, emphasizes the establishment of oak and includes planting.

The project area is located in southwestern Pope County and southeastern Massac County, Illinois (T14S, R5E and R6E; T15S, R6E and R7E) (Figure 1). It includes the Burke Branch, Robnett Barrens and Dog Creek sub-project areas in the Cretaceous Hills Subsection of the Forest (Figure 2).

Table 1 summarizes the project decision and the objectives the actions are intended to meet, which also includes all the elements of alternative 4 described in detail in the FEIS Volume I (pages 17–19 and 23–25) and FEIS Volume II, including the following appendices:

- Appendix B – Vegetation Treatments (pages 71– 79)
- Appendix C – Prescribed Fire
- Appendix D – Invasive Plants
- Appendix E – Wildlife
- Appendix F – Proposed Roadwork
- Appendix G – Monitoring and Compliance

In addition, the selected alternative includes all of the design features common to all alternatives described on pages 26–30 of the FEIS (see also Design Features and Best Management Practices on page 18 of this document).

The referenced project documents are saved on Pinyon and/or the T-drive in the following links:

- [Final FEIS and Final Specialist Reports – LINK](#)
- [Record of Decision – LINK](#)
- [GIS data – LINK to Decision data](#)

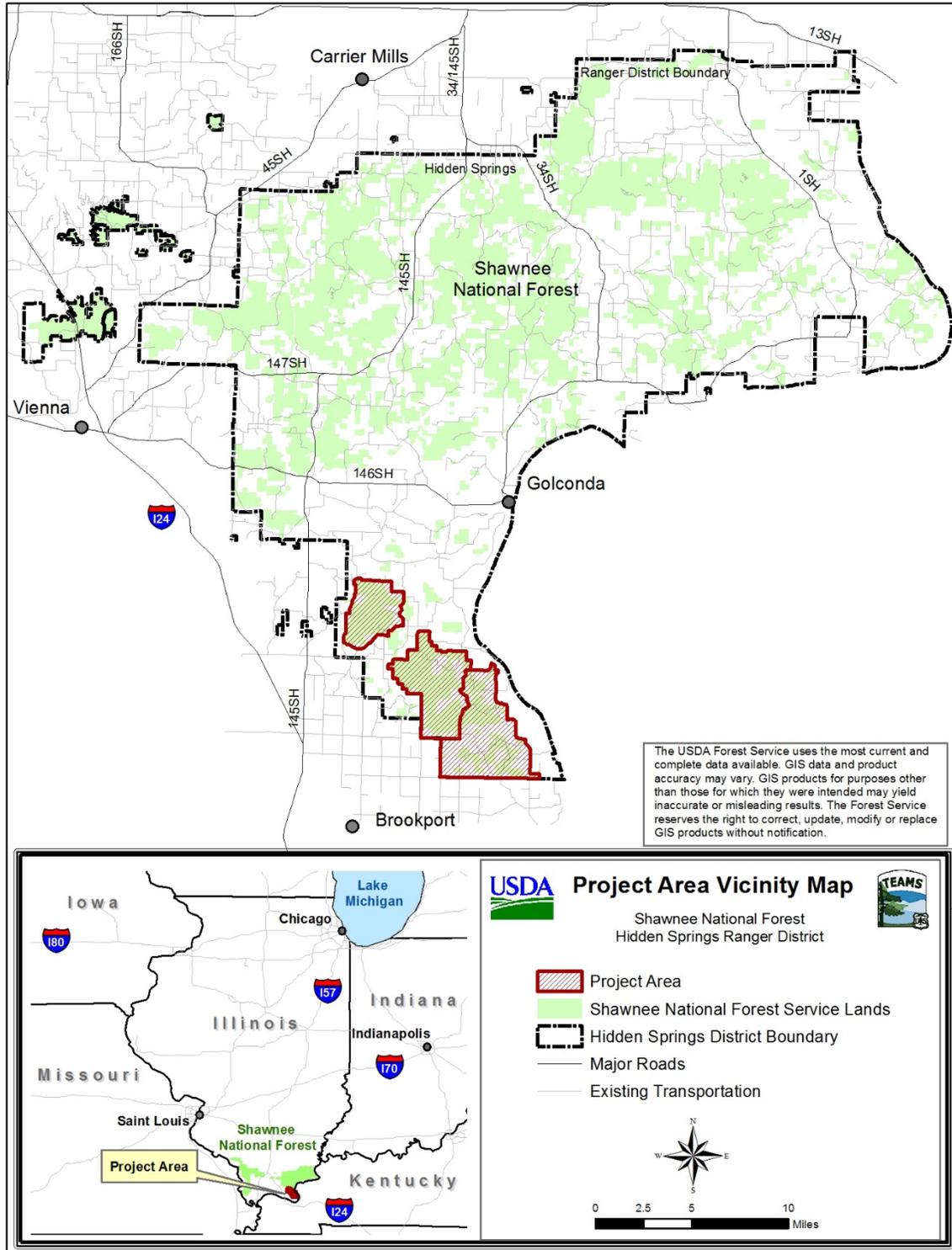


Figure 1: Project Vicinity Map

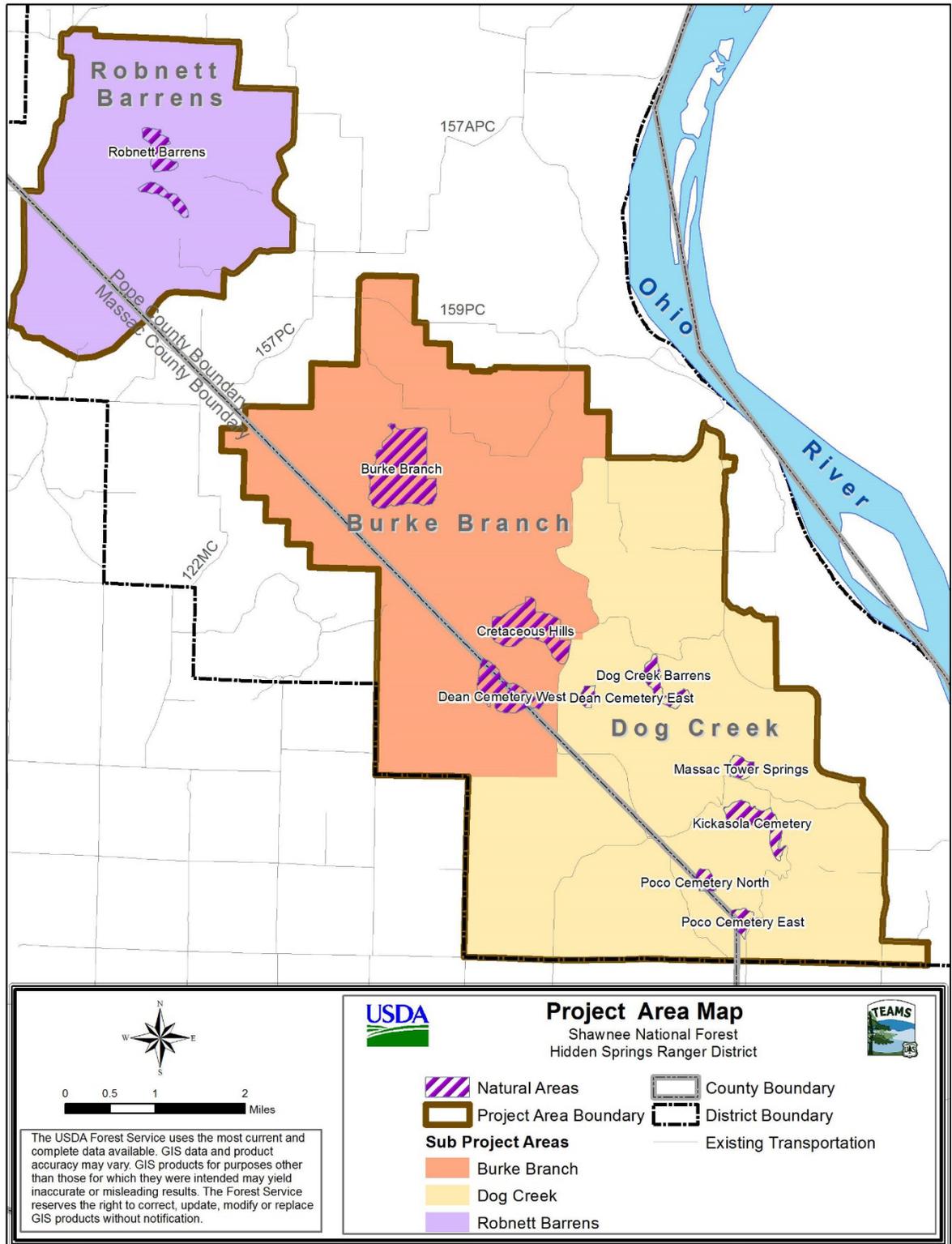


Figure 2: Cretaceous Hills Ecological Restoration Sub-project areas and natural areas map

Table 1. Summary of the selected alternative, alternative 4

Category and Objectives	Activity	Amount
Forest Management¹ <i>Objectives met: Remove pine adjacent to and not associated with natural areas, provide a diversity of habitat conditions, restore disturbance-dependent ecosystems, human and community development</i>	Intensive shelterwood establishment cut – Initial entry	1,200 acres
	Light shelterwood establishment cut – Initial entry	2,050 acres
	Timber stand improvement treatments – site preparation for natural regeneration – Initial entry	3,200 acres
	Pine overstory removal with leave trees – Second entry	3,200 acres
	Timber stand improvement– site preparation for natural regeneration – Second entry	3,200 acres
	Oak planting (as part of timber stand improvement) ²	2,900 acres
	Number of temporary openings greater than 40 acres	22
Prescribed Fire <i>Objectives met: Restore disturbance-dependent ecosystems, reduce coverage of invasive plants, and reduce fuel loading, human and community development</i>	Landscape prescribed burning	15,000 acres
	Activity-fuel prescribed burning (as part of timber stand improvement)	3,200 acres
	Fireline using existing features (roads, streams, rights-of-way)	Up to 102
	Fireline construction (hand-developed)	21 miles
	Fireline construction (interior bulldozer line)	11 miles
	Fireline construction (exterior bulldozer line) ³	Up to 65 miles
Invasive Plant Treatment <i>Objectives met: reduce coverage and spread of invasive plants</i>	Invasive plant mechanical small tree and shrub removal (predominantly in Robnett, Dean East, Dog Creek, Burke Branch natural areas)	up to 445 acres
	Existing infestations proposed for treatment with herbicide ⁴	6,700 acres
Wildlife habitat <i>Objectives met: provide a diversity of wildlife habitat</i>	Vernal pond habitat development	25 acres
Roadwork <i>Objectives met: provide future administrative and public access</i>	New system roads constructed	4.3 miles
	Road reconstruction	22 miles

1 - Treatment acres are approximate and could vary up to 10 percent or more due to operational constraints and resource concerns identified during project layout and implementation. In addition, prescription assignments – especially under alternative 4 – must be field verified post-NEPA analysis during silviculture prescription development.

2 - Priority would be given to pine treatment units with fewer than 150 potential crop trees per acre with diameter at breast height of at least 0.5 inches and to those units in or adjacent to natural areas. Underplanting oak is a critical component of alternative 4 (see FEIS Volume II, Appendix B).

3 – Exterior bulldozer line is included for analysis purposes only. It is likely that these boundary dozer lines will not all be created because either: (1) we will collaborate with neighboring landowners and utilize an existing fireline feature outside of national forest boundary or (2) we will utilize a natural or existing fireline within National Forest System lands (see FEIS Volume II, Appendix C).

4 - The table lists the current acres of invasive plant treatment areas; however, it is anticipated that additional infestations will be discovered and actual treatment acres will be larger over time. Application rates would not exceed the label rate on the herbicides applied (see FEIS Volume II, Appendix D).

Purpose of the Implementation Guide

The purpose of the implementation guide is to provide a tool for implanting the project in a way that is consistent with the project Decision and for regular coordination between the implementation team and resource specialists. In addition, this guide captures how the design criteria are implemented to be effective in minimizing impacts. The implementation guide aids in tracking adaptive management actions such as determining timing and order of herbicide, timber harvest, and fire treatments. As activities are implemented and monitored, the guide will be continually reviewed and updated as needed to improve implementation of the project.

Detailed Description of the Activities

Forest Management

Where oak is already well established, we would implement an Intensive 2-Step Shelterwood Establishment Cut to open the canopy and release existing oak. Where oak is not yet well established, we would implement a less aggressive Light 2-Step Shelterwood Establishment Cut and leave the overstory canopy relatively intact to promote oak regeneration and development of oak advanced reproduction. In addition, we would under plant oak after the light initial entry treatment. See a map in Figure 3 and a decision tree in Figure 4. Under both the intensive and light initial entry treatments, the remaining residual pine would be removed during a second entry. Hardwood trees remaining after the initial entry would be left indefinitely or until after a future environmental analysis decision approves additional treatment. Mechanical treatment would be followed by timber stand improvement (TSI) treatments. Prescribed burning could occur before or after mechanical treatment, depending on operational constraints and opportunities. **In all cases the management action will be based upon verification of stand conditions and current data. Detailed silvicultural prescriptions will be prepared for every stand.**

Based on current inventory data, 44 pine treatment units (1,128 acres) would be treated intensively, and 79 pine units (2,043 acres) would be treated lightly (Appendix B1 – Alternative 4 Pine Unit Mechanical Treatments)

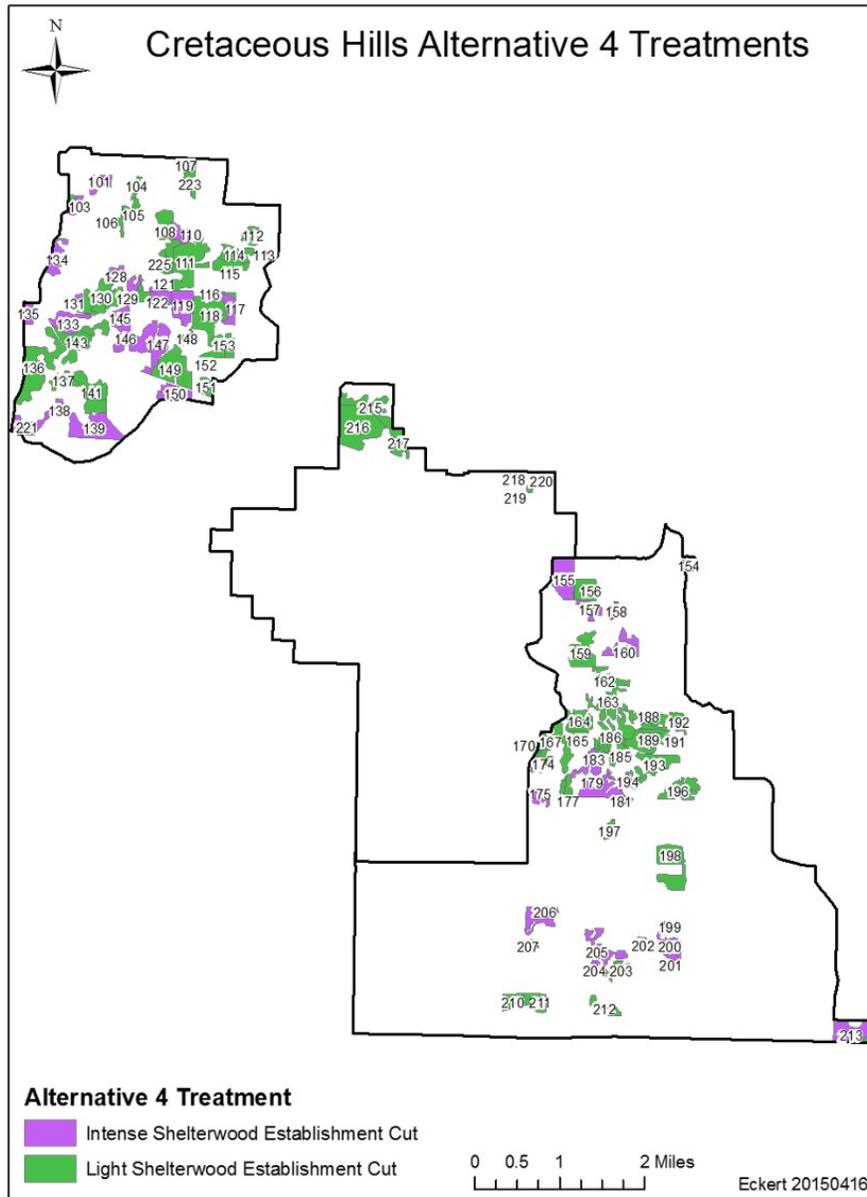


Figure 3: Tentative treatment types by unit

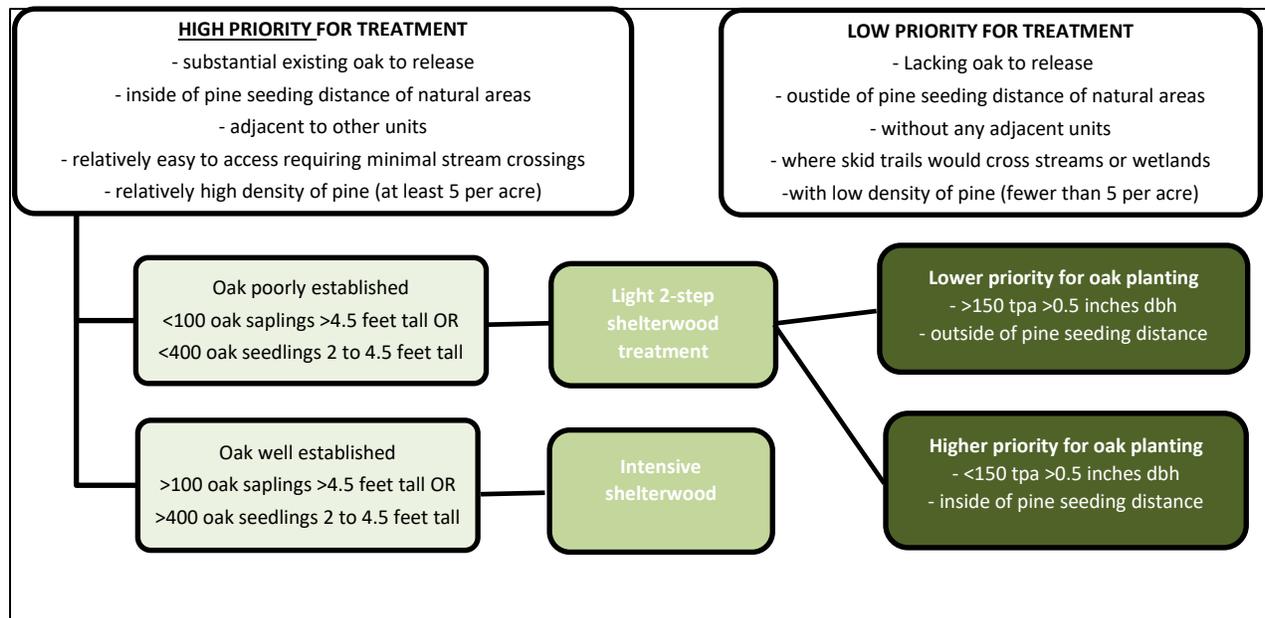


Figure 4: Treatment Decision Tree

Intensive shelterwood

The *intensive shelterwood establishment cut* would be implemented in pine units where there are at least 100 oak saplings at least 4.5 feet tall or at least 400 oak seedlings 2.0 to 4.5 feet tall per acre.

Intensive Initial Entry

- Reduce stand density to 31 to 40 square feet per acre
- Cut both pine and hardwood trees to achieve a residual stand of about 50 percent pine and 50 percent hardwoods (by basal area), as feasible given initial forest composition
- hardwood basal area would be reduced to 15 to 20 square feet per acre

Intensive Second Entry

The remaining pine would be removed during a pine overstory removal (with leave trees) treatment approximately 5 to 20 years after the initial entry, once the following conditions are met:

- Advanced reproduction is considered adequate. Based on guidance in the Hoosier Forest Plan, advanced regeneration would be considered adequate when at least 150 potential oak and hickory crop trees¹ are present per acre. This stocking level is based on the likelihood of regenerating a fully stocked oak-hickory stand. Note that the Shawnee Plan does not have standards for oak

¹ The average diameter of potential crop trees must be at least 0.5 inches diameter at breast height. Potential crop trees must also be well distributed over the regeneration area. In some units, prescriptions may call for less oak and hickory due to the many factors that inhibit regeneration of the oak-hickory forest type. In these units species other than oak and hickory (such as yellow-poplar, elm, sweetgum, maple, and locust) will make up part of the 150 potential crop trees.

seedling or sapling densities that would trigger management actions in pine stands.² As an alternative, we are borrowing from the Hoosier National Forest Land and Resource Management Plan (2006), because the Hoosier guidance is consistent with research, is for somewhat similar sites (although often more productive), and seems like a reasonable approach to accomplishing the goals stated by commenters, that drive alternative 4.

- More than 30 square feet per acre hardwood tree basal area is present after accounting for anticipated logging damage.
- Some units already have the desired 150 potential oak and hickory crop trees per acre, but time would still be required before implementing the second entry for hardwood stocking to recover to more than 30 square feet per acre (after accounting for anticipated logging damage, so perhaps more like 40 square feet per acre hardwood basal).

Light 2-Step Shelterwood

The *light shelterwood establishment cut* would be implemented in pine units where there are, per acre, fewer than 100 oak saplings taller than 4.5 feet and fewer than 400 oak seedlings 2.0 to 4.5 feet tall.

Light Initial Entry

- Cut both pine and hardwood trees to reduce total stand density to 50 to 70 square feet per acre
- Leave 30 to 40 square feet per acre pine basal area
- Leave 20 to 30 square feet per acre hardwood basal area
- Planting of oak seedlings

Oak Planting

Units would be given higher priority for planting where oak regeneration is lacking ($< 150 \text{ tpa} \geq 0.5$ inches dbh) and inside pine seeding distance of natural areas.

Oak-hickory composition objectives vary by ecological units as listed below:

- Illinois Ozarks – 60 to 75 percent in uplands and 25 to 50 percent on low slopes and alluvial plains;
- Greater and Lesser Shawnee Hills land type associations (LTAs) 1, 2, 4, 5, 7 – 70 to 90 percent in uplands and 30 to 90 percent on low slopes and alluvial plains;
- Greater and Lesser Shawnee Hills LTAs 3 and 6 – 85 to 100 percent on uplands and 30 to 85 percent on low slopes and alluvial plains.

Planting could occur for two reasons and timing of planning and implementation of planting could differ based on reason for planting. A discussion of planting under these two scenarios follows:

1. To achieve desired contribution of oak, the final recommendation to plant would have to be made by the silviculturist when developing the silvicultural prescriptions; detailed, unit-specific silvicultural prescriptions are developed after NEPA analysis (within the sideboards of the

² The Shawnee National Forest Plan emphasis on the restoration of the oak community in lands planted to pine includes first converting them back to native hardwood, with tolerance given to other hardwood trees such as tulip poplar, elm, sweetgum, maple, locust and oaks and hickories. The Shawnee Plan does not contain standards for oak contribution in pine stands, because such standards are not necessary to direct the removal of pine. Burning to increase oak and hickory contribution is a secondary emphasis of the Plan.

analysis) typically before project layout. The silviculturist would visit every pine treatment stand before making this decision.

2. The Forest Service is required to regenerate stands within 5 years of certain treatments. If monitoring indicates that a stand will probably not naturally successfully regenerate in that time frame, a decision to plant would be made 3 years after initial treatment. We anticipate, however, that most, if not all, pine units would successfully regenerate to hardwoods after treatment. The Shawnee Forest Plan (and the National Forest Management Act) is not specific about oak contribution, so sufficient regeneration of any tree species would satisfy this legal requirement.

The best time to plant is immediately after (the spring following) the initial mechanical treatment or after prescribed burning, if burning will occur soon after the initial mechanical treatment. Estimates of seedling need and tree orders should be made soon after an EIS record of decision is signed so that trees will be available. Planting need should be verified during silvicultural prescription development.

Light Second Entry

The remaining pine would be removed during a pine overstory removal (with leave trees) approximately 5 to 20 years after the initial entry once the following conditions are met:

- Advanced reproduction is considered adequate. Based on guidance in the Hoosier Forest Plan, advanced regeneration would be considered adequate when at least 150 potential oak and hickory crop trees are present. This stocking level was developed based on the likelihood of regenerating a fully stocked oak-hickory stand.
- More than 30 square feet per acre hardwood tree basal area is present after accounting for anticipated logging damage.

Light Third Entry (optional)

If oak is not planted after the light treatment, then in some units a more prolonged 3-step shelterwood system might better achieve desired oak contribution. Under the 3-step shelterwood system, the first cut (midstory removal or preparatory cut) typically promotes seed production and establishment of seedlings, the second cut (establishment cut) releases the established regeneration, and the third cut (final removal cut) removes the remaining overstory trees (or just the remaining pine trees in the case of the Cretaceous Hills Project).

Timber Stand Improvement

TSI treatments would be implemented on all units proposed for mechanical treatment (pine units), as funding permits. Timber stand improvement (TSI) treatments focus on cutting and/or spraying of trees less than 10 inches diameter at breast height, including oak competitor shade-tolerant trees (such as sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), American elm (*Ulmus americana*), ash species (*Fraxinus* spp.), and poplar species (*Populus* spp.)) and damaged oak trees.

Trees damaged during mechanical treatment could also be cut back to stumps to promote sprouting of new healthy, vigorous stems.

Cut some understory oak trees—such as those damaged during recent ice storms now with dead tops or poor form—typically within 6 inches of the ground to produce quality sprouts. Healthy oak trees that are still standing straight would be retained, treated as a crop tree, and released from competition. Accomplish crop tree release and site preparation simultaneously during the same timber stand improvement entry.

TSI treatments, including herbicide treatment, would also be important where prescribed burning stimulates sprouting of young pine, which can sprout when the above-ground stem is killed or badly damaged.

Activity Fuels and Prescribed Burning

Prescribed burning could occur before or after harvest and would both create site conditions favorable for oak regeneration and release existing understory oak.

On approximately 3,171 acres for activity fuel (slash or tree tops) reduction following pine harvesting. These fuels typically remain after the merchantable material is removed during harvesting. These areas may be burned separately or along with the other landscape-level prescribed burning units. Several burn entries may be needed to consume a majority of the activity fuels associated with harvest, depending on the intensity or severity of the initial burn. Once the activity fuels have been consumed, several subsequent burns on these acres would likely be needed to promote the ecological benefits stated above for landscape burning.

Treatment Priority

Mechanical treatment might not be justified in all pine units, depending on treatment benefits, resource impacts, operational constraints, availability of funding, and treatment cost. Treatment priority would be higher for pine units with the following characteristics:

- Adjacent to other pine units proposed for treatment
- High density of pine (i.e., at least five inventoried pine trees per acre)
- Substantial existing oak ready to release
- Inside pine seeding distance of Natural Areas
- Easily accessible with minimal skid trail and temporary road crossing of streams and wetlands

Treatment priority is identified in table 3 for pine units with fewer than five inventoried pine trees per acre. We would consider dropping mechanical treatment or cutting and leaving the pine in lower priority units.

Table 2. Treatment priority is identified for pine units with fewer than five inventoried pine trees per acre

Pine Treatment Unit	Pine Unit Size (acres)	Oak TPA ≥ 0.5 " dbh > 30 (Oak TPA ≥ 0.5 " dbh)	Adjacent units proposed for treatment?	In or Adjacent to Natural Areas?	Score
102	4	No (9)	Yes	No	1
105	17	No (15)	Yes	No	1
115	31	No (5)	Yes	No	1
121	15	Yes (40)	Yes	Yes	3
122	15	Yes (40)	Yes	Yes	3
123	3	No (0)	Yes	No	1
125	15	No (0)	Yes	Yes	2
151	19	No (0)	No	No	0
201	12	Yes (36)	Yes	Yes	3
206	46	No (6)	No	No	0

Pine Treatment Unit	Pine Unit Size (acres)	Oak TPA \geq 0.5" dbh > 30 (Oak TPA \geq 0.5" dbh)	Adjacent units proposed for treatment?	In or Adjacent to Natural Areas?	Score
214	8	No (7)	Yes	No	1
221	25	Yes (105)	No	No	1
222	10	Yes (105)	No	No	1

Answers of yes are counted as one point and answers of no are counted as zero points. Lower score indicates more reason to consider dropping mechanical treatment or, as an option, considering cutting and leaving the pine. Treatment priority (and score) is higher for units with plentiful oak ready to release, adjacent to stands proposed for concurrent treatment, and in or adjacent to Natural Areas.

*TPA=Trees per acre

The prioritization process provided here could be applied to additional units if issues (i.e., wetlands) are discovered during silviculture prescription development or project layout. Final unit-specific treatment assignments would be made by the District after completion of silviculture prescriptions.

Landscape Prescribed Fire

Prescribed burning opportunities (windows) are limited by leaf litter (fuels) accumulation and distribution, weather, predicted fire behavior, air quality, and operational constraints (i.e., availability of personnel and funding), as well as environmental constraints (e.g., protection measures for the Indiana bat). To maximize benefits across the project area, we would implement prescribed burns at a landscape scale when feasible within these constraints.

We will consider the following when setting priorities for implementing prescribed burning. It should be noted this list is neither complete nor necessarily in order of importance.

- ◆ Benefits to special habitats/rare plants/natural areas
- ◆ Areas with the greatest departure from historic conditions
- ◆ Opportunities to reduce fuel hazard and fire risk
- ◆ Ability to maintain and develop relationships with cooperators
- ◆ Efficient return of fire to its natural role in the ecosystem with consideration for risks
- ◆ Coordination with silvicultural and / or noxious weeds treatments
- ◆ Ability of the burn unit to meet multiple objectives as outlined in the environmental documentation and as identified by agency direction

Table 4 displays a summary of the proposed prescribed burning activities. For a list of individual activities and maps, see appendix A. See below for a description of the various types of firelines.

Table 3. Summary of proposed prescribed fire activities

Prescribed fire by area	Number of Burn Block Units	Acres
Dog Creek	81	4,467
Burke Branch	84	6,838
Robnett Barrens	30	3,821
Total all areas	195	15,126

Prescribed fire by area	Number of Burn Block Units	Acres
Associated firelines – all areas	Miles	Acres
Existing – all areas	102	191
Existing roads	71	129
Creeks and streams	29	55
Rights-of-way	2	7
Constructed firelines – all areas	112	110
Hand lines	21	29
Bulldozer (interior lines)	11	11
Bulldozer (lines along private)	65	63

*Includes 2 miles of roads to be created for timber harvest

Burn units may be dropped or combined, or divided as appropriate at the time of implementation. Such changes would be compared to the analysis of effects prepared for this project before implementation would begin. As a result of combining burn units, some interior control lines would not be needed. This would typically result in less impact than analyzed for some resources.

Where burn units join private property, we have the ability to partner with the adjacent landowner and create a burn unit that includes both National Forest System lands and private property. This partnership is encouraged under the Wyden Amendment (Public Law 105-277, Section 323 as amended by Public Law 109-54, Section 434). The Forest Service already has some Wyden Agreements that do not appear on the maps. This may increase the size of burn units and reduce constructed fire lines, by expanding to an appropriate fire control feature on lands of other ownership. Note that the FEIS does not analyze environmental effects of burning on private lands. Additional analysis may be required. Refer to FSH 1909.15 Chapter 10 for determining if NEPA applies.

Proposed fireline locations displayed on the maps are based on our most current information. Before implementation, these control lines will be field verified to ensure that they are located in the appropriate location, and that the appropriate control line will be used (hand line, bulldozer, etc.), depending on circumstances at the time of implementation.

Burn Plans

Burning would take place under the guidelines set forth in a prescribed fire burn plan developed specifically for this project area. Prescribed burn plans address parameters for weather, air quality, and contingency resources. The burn plan will address mitigation measures to minimize smoke impacts and to comply with State and Federal air quality regulations. All burning will be conducted using well-established smoke management procedures in conjunction with the appropriate State and county authorities.

Mitigation of smoke-related impacts caused by prescribed fires will be addressed in the prescribed burn plan format and monitored in accordance with State air quality regulations. By planning and executing prescribed fires on days that have fair to excellent smoke dispersion and by avoiding smoke-sensitive areas, the negative effects of smoke can be reduced. Implementing these requirements does not completely eliminate the risk of smoke impacts from prescribed fire; for example, unforeseen changes in weather and equipment failures can cause unanticipated smoke intrusions.

Non-native Invasive Plant Treatment

Non-native invasive plant treatments would prioritize:

1. Treatment of known sites of five highly invasive species: Amur honeysuckle, Chinese yam, garlic mustard, kudzu, and Nepalese browntop. See table 14 and figure 5 for known occurrences and acreage of these species in the project area.
2. Management of natural areas and their treatment zones, including control of invasive species. The following natural areas were identified for treatment in the 2014 project: Cretaceous Hills, Dean Cemetery West, Kickasola Cemetery, Massac Tower Springs, Poco Cemetery East and North, and Snow Springs (USDA Forest Service 2014). Noxious weed treatment includes the footprint of these areas and associated treatment zones. Treatment zones were developed along streams, roads and trails—the main pathways of invasive species infestation—adjacent to and generally upstream of the natural areas. This project would propose NNIS treatments, including chemical control for the remainder of the natural areas, with associated treatment zones (figure 12), that exist in the project area: Robnett Barrens, Dean Cemetery East, Dog Creek Barrens, and Burke Branch.

Additionally, newly discovered NNIS infestations within the project footprint would be treated utilizing mechanical, fire, and/or chemical control methods.

Invasive species that are new to the Shawnee National Forest or state would be treated by consulting the best available science to determine the most efficient treatment methods. Treating new invaders in an early detection/early response system, while population size is low and manageable, is the most cost effective and efficient approach.

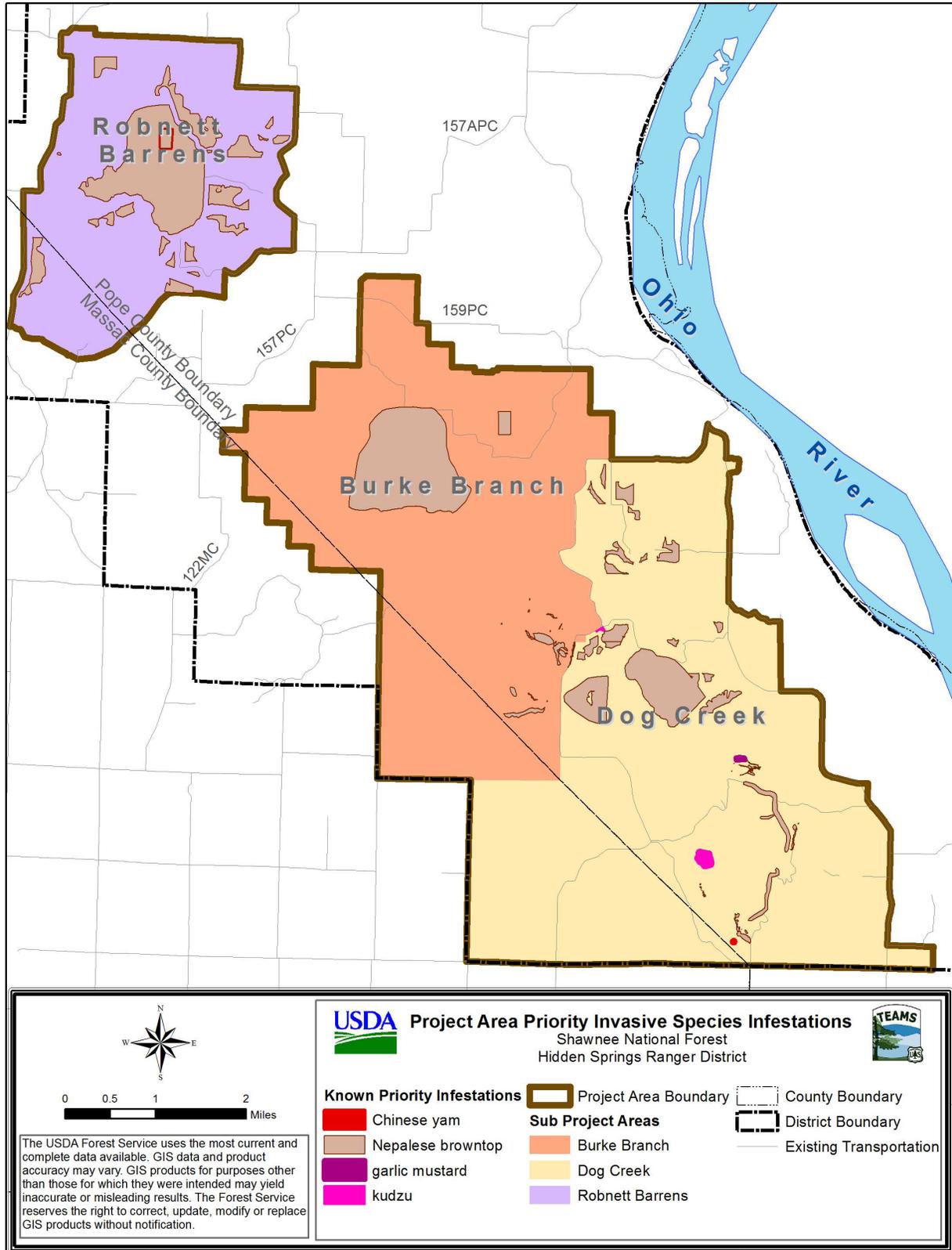


Figure 5. Project area priority invasive species infestations

Treatment methods may include:

- Manual, using the hands alone or the hands with tools, including: pulling using hands or a weed-pulling tool, cutting/clipping using cutting tools, grubbing using a grub-hoe or similar tool, smothering using environmentally benign materials to cover targeted plants, and scorching using a gas-flamed torch to burn up targeted plants;
- Mechanical, using a bulldozer or tractor with bushhog, for example, to remove targeted plants. These would be used to remove usually larger, densely growing, woody plants; or,
- Chemical, using a hand-held applicator, backpack sprayer or boom mounted spray rig, using the chemicals listed in Table 5.

Table 4. Proposed chemical controls

Chemical Name	Examples of Trade Names	Targeted Use	Examples of invasive plants to be targeted	Risk Assessment
Clopyralid	Curtail™ Reclaim™ Transline™	Foliar spray; broadleaf selective—especially legumes, smartweeds (<i>Polygonaceae</i>), and composites	Kudzu, sericea lespedeza, oxeye daisy, crown vetch	Durkin 2004a
Glyphosate	Accord® Foresters®	Woody and broadleaf plants: stump treatment, 10-20% solution; foliar spray; non-selective	Amur honeysuckle, autumn olive, Japanese honeysuckle, garlic mustard, multiflora rose	Durkin 2011a
Glyphosate (aquatic)	Aquamaster® Rodeo®	Foliar treatment, invasives near open water, non-selective	Purple loosestrife, common reed, any species near open water	Durkin 2011a
Picloram	Tordon K Tordon 22k; Grazon	Stump and/or basal-bark treatment	Kudzu, autumn olive, tree of heaven, black locust	Durkin 2011b
Sethoxydim	Poast® Vantage®	Foliar spray; narrowleaf selective (grasses)	Nepalese browntop, Canada bluegrass, bald brome	Durkin 2001
Triclopyr	Crossbow™ Garlon™3A Garlon™4 Habitat®; Pasturegard™ Vine-X®	Stump and/or basal-bark treatment, foliar spot spray; broadleaf selective; woody plants	Chinese yam, kudzu, amur honeysuckle, autumn olive, sericea lespedeza, Japanese honeysuckle	Durkin 2001

Additionally, new reduced risk herbicide alternatives could be used during the lifetime of the project as long as a Syracuse Environmental Research Associates risk assessment (or equivalent) had been conducted to analyze herbicide effects to humans and wildlife species.

A Pesticide Use Proposal (FS-2100-2), and safety plan (FS-6700-7) would be prepared before any herbicide use. All treatment locations would be marked with global positioning systems and tracked in the database of record.

Table 5. Invasive species and recommended treatments, for species which may occur, but are not currently known to occur in the project area

Species	Treatment Method
Broadleaf Plants	
Adam's needle, yucca	Remove entire plant by hand and grub out root.
Asiatic dayflower	Hand-pull where control is desired.
Beefsteak plant, curly dock	Apply triclopyr at 3-5% solution before bloom or seedset in areas where broadleaf-selective herbicide is preferable; alternatively, glyphosate may be applied at 2-3% solution where non-selective herbicide is acceptable.
Bindweed	Apply glyphosate at 2-3% solution on heavy infestation in summer-early fall. Extensive root systems of established infestations may require repeat applications.
Common sheep, common dandelion	Hand-pull individuals where possible, removing taproot. Alternatively, apply triclopyr at 3-5% solution to young, growing plants, ideally before seeding.
Common St. Johnswort, Sleepydick	Apply glyphosate at 2% solution.
Grassy Plants	
Bald brome, Canada bluegrass, Kentucky bluegrass, smooth brome	Apply fire in late spring after plants are growing, and in late season to ensure control. If application of fire or repeat fire is not possible, apply sethoxydim at 3% solution to new growth.
Japanese bristleglass	Do not burn. Apply glyphosate at 2% solution or sethoxydim at 3% solution in late spring before warm-season grasses appear; the former where use of non-selective herbicide is acceptable, the latter where a grass-selective herbicide is more desirable.
Orchardgrass, tall fescue	Single clumps can be dug, ensuring whole plant and all stems are removed. If digging is not practical, apply glyphosate at 2% solution when plants are actively growing and not stressed.
Reed canarygrass	Apply fire in late spring; apply glyphosate at 2% solution in June and September to ensure control.
Leguminous / Composite Plants	
Bristly oxtongue	Remove by digging if possible. If large infestation, apply glyphosate at 2% solution.
Bull thistle	Apply fire in late spring, if possible, to increase exposure of rosettes to herbicide application. Apply glyphosate in 2.5% solution to plants in late bud-stage or early bloom-stage and root reserves are lowest.
Common mullein	Mullein is prolific seed-producer; treatments should be done prior to seeding to effect control. Cut plant below crown prior to seeding, if possible. Alternatively, apply glyphosate or triclopyr at 2% solution to rosette when plant is actively growing.
Crownvetch	Apply triclopyr at 2% solution before seed maturity; clopyralid may be applied at 2% solution if a more legume-specific herbicide is desired.
Lesser burdock	Apply glyphosate at 2% solution to actively growing plant rosettes.
Oxeye daisy	Apply an herbicide containing at least 40% (21 ounces to the gallon) clopyralid at 3% to actively growing plants.
Woody Plants	
Wintercreeper	Hand-pull and grub small populations, removing all parts of the plant from the site. Otherwise, cut plant as close to ground as possible and apply triclopyr in 2% solution to cut surfaces.

Wildlife Habitat Improvement

Wildlife treatments include developing up to 25 vernal ponds at varying sites across the project area. The specific locations of vernal ponds are to be determined during project implementation.

The sites will be identified during timber sale layout, would vary between approximately one-tenth and one-half acre in size, and would be located in upland forested habitat outside of natural areas. Treatment would consist of digging out a small depression either by hand or using a backhoe. Where soils are unlikely to hold water, we would place a liner and cover the liner with soil. The soils in the project area are primarily a silty loam soil with an impermeable layer. Therefore, it is anticipated that vernal ponds could be constructed many locations without the use of liners. However, soils would be evaluated at each proposed site and the guidance for the use of liners in Biebighauser (2002)³ would be followed. An area of up to approximately three-tenths of an acre may be disturbed during development and any disturbed areas outside the pond would be seeded with native vegetation. Each site will be located in an area that will collect water and the pond will fill naturally.

Roads

System road construction and reconstruction would occur to remove forest products, provide access for future management opportunities and meet the Forest Plan goals for public access within the analysis area. See appendix C for the roadwork and maintenance that was considered in the Decision.

Once maintenance, reconstruction, or closure work occurs on the ground, the associated Motor Vehicle Use Maps would be included in the next annual version.

Activity sequencing and timing

The forest management, prescribed fire, and non-native invasive plant treatments may occur in the same locations and in different sequence depending on the location and situation. The decision and analysis includes some considerations regarding timing of treatments:

- When burning in pine stands, care must be taken to minimize subsequent pine sprouting. Winter burning is thought to promote the highest level of shortleaf sprouting and spring burning the least (Shelton and Cain 2002). Prescribed fire is also a very effective site-preparation method for loblolly pine regeneration (Trousdel and Langdon 1967). Monitoring pine stands would be essential after any mechanical or burn treatments to determine the need for herbicide control of pine regeneration. Herbicide treatment of pine seedlings would be intended to prevent pine from surviving long enough to join the midstory and overstory. Treatment of even a single stem may be justified if weeds are being treated in the immediate vicinity. In areas removed from other ongoing herbicide treatments, monitoring would help managers determine whether the pine seedlings are dying out in the understory or if they are surviving to potentially join the midstory and overstory, in which case herbicide treatment would be necessary.
- Prescribed fire treatment in September and October may best **control** Nepalese browntop, when it is flowering but before seed set (Gibson, Spyreas, and Benedict 2002 and Mohlenbrock 1986). Annual treatments could impede Nepalese browntop seed production and diminish Nepalese

³ Biebighauser, T.R. 2002. Creating Vernal Ponds. USDA Forest Service in cooperation with Ducks Unlimited and the Izaak Walton League of America. 36 pp.

browntop seed banks (Gibson, Spyreas, and Benedict 2002). Repeated burning of Nepalese browntop, if conducted between flowering and seed production may be the most effective means to control the species with prescribed fire.

- Spring and fall burns might best limit shortleaf pine sprouting and Nepalese browntop response, respectively. Periodic summer burning at intervals of three or more years might best promote oak. However, because of concerns for Indiana and gray bats, summer burning would not be used.

Design Features and Best Management Practices

We would incorporate design criteria and mitigation measures into any of the action alternatives in order to reduce adverse impacts and achieve desired outcomes. These measures are guided by the Forest Plan, USDA Forest Service and State best management practices, project-specific objectives, and issues identified during scoping and effects analysis. Implementation of the design criteria and mitigation measures is required, and should be incorporated into any contracts and timber sales.

In Table 1, the design features are organized for ease of application to activities and certain resource conditions. Reference to the Final Environmental Impact Statement Design Feature number is provide.

Table 6: Design features by activity and condition

Activity	Condition for which design features applies	Design Feature	Resource Projected, FEIS Design Feature Number
All	All	To prevent the spread of invasive species, inspect clothing and equipment before entering or leaving the project area and remove and properly dispose of mud, dirt, and plant parts.	Botany, B-1
All	All	Follow the State of Illinois Forestry Best Management Practices for pesticide use (see Forestry BMPs, pages 41 to 43) as well as the National Best Management Practices for Water Quality Management on National Forest System Lands (April 2012. For pesticide use (see Chemical Use Management Activities BMPs, pages 30-38).	Soil and water, SW-1
All	All	Conduct an inventory of the Area of Potential Effects to ensure that all heritage resources are adequately protected from project-related impacts.	Heritage, H-2
All	All	Monitor project area following implementation to assess the thoroughness of the present inventory.	Heritage, H-3
Timber harvest, fireline, road construction	Acid seeps	Prior to implementation of timber harvest, road construction, or fire line activity, locate acid seeps. These areas will be avoided by mechanical treatments.	Soil and water, SW-13
Mechanical and chemical treatments	Rare plant locations	Protect rare plant resources, including State-listed Threatened and Endangered species when requested by the State, from mechanical or chemical treatments.	Botany, B-3
Vernal pond and fireline	Rare plant locations	Survey vernal pond (vernal pool) areas and fireline dozer/handline construction areas prior to project implementation.	Botany, B-4
Silviculture	All	Falling would be done using methods that minimize breakage and damage to residual trees. For example, as feasible, trees would be directionally felled away from oak and hickory trees to prevent placing tree tops near the bases of desired residual trees.	Silviculture, S-1
Silviculture	All	Silvicultural prescriptions would be developed or reviewed by a certified silviculturist for each treatment unit after field reconnaissance.	Silviculture, S-2
Silviculture	All	As feasible, avoid accumulating slash within 10 feet of the bases of oak and hickory trees.	Silviculture, S-4
Silviculture	All	Follow "Snag and Cavity Management for Thinning and Timber-Stand Improvement, Tables H-1 and H-2, and standards listed on pages 288-290, 2006 Forest Plan Appendix H—Strategies and Guidelines for Conservation of Biological Diversity.	Threatened and Endangered Bats, W-7
Silviculture	All	Apply marking paint on trees so it is not visible from travelway or use areas.	Visuals, V-2

Activity	Condition for which design features applies	Design Feature	Resource Projected, FEIS Design Feature Number
Silviculture	Known occupied northern long-eared bat maternity roost trees	Protect known occupied northern long-eared bat maternity roost trees during prescribed fire or silvicultural activities.	Threatened and Endangered Bats, W-6
Silviculture	Within 150 foot radius of known northern long-eared bat maternity roost	Avoid cutting any known, occupied northern long-eared bat maternity roost trees or any other trees within 150-foot radius of the maternity roost tree during June 1 – July 31	Threatened and Endangered Bats, W-11
Silviculture	Within 5 miles of known Indiana bat roosts or hibernacula, including Brasher Cave	Known roost trees will not be removed through harvesting. Management of these areas should maintain a diversity of age, size, and species classes of potential roost trees.	Threatened and Endangered Bats, W-5
Silviculture	Within 0.25 miles of known northern long-eared bat hibernacula	Within 0.25 mile of known northern long-eared bat hibernacula, all tree-clearing activities will be prohibited.	Threatened and Endangered Bats, W-10
Silviculture	Streambanks	Use the best management practices defined by National Best Management Practices for Water Quality Management on National Forest System Lands (April 2012) to guide management activities with regard to streambank restoration and/or stabilization and management of large, woody debris.	Soil and water, SW-2
Silviculture	Streambanks or ponds	Fell trees away from streams and ponds where practicable and remove logging-slash by hand or cable far enough to prevent slash from accumulating in perennial or intermittent stream channels, and ponds.	Soil and water, SW-4
Silviculture	Perennial streams	Delineate a 100-foot riparian filter-strip extending outward from each side of perennial streams. No cutting of standing trees from 0-25 feet. Retain a minimum basal area of 50-60 within 26-100 feet. Allowable bare-soil exposure limit is 10% of each 150-foot linear segment of filter-strip.	Soil and water, SW-6
Silviculture	Intermittent streams	Delineate a 50-foot riparian filter strip extending outward from each side of intermittent streams. No cutting of trees on streambanks. Retain a minimum average of 50-60 basal area 0-50 feet in the riparian filter strip. Allowable bare-soil exposure limit is 10% of each 150-foot linear segment of filter strip	Soil and water, SW-7
Silviculture	Ephemeral streams	Maintain a 25-foot riparian filter strip extending outward from each side of ephemeral streams. Retain a minimum average of 40-50 basal area 0-25 feet in the filter strip. Allowable bare-soil exposure limit is 10% of each 150-foot linear segment of filter strip.	Soil and water, SW-8
Silviculture	Ponds and wetlands	Maintain a 100-foot filter-strip within extending from ponds or wetlands and refrain from dropping trees into or across ponds. Refrain from operating heavy equipment in wetlands. Bare soil exposure is limited to 10% of each 150-foot linear segment of filter-strip. Provide leave-trees to shade ponds.	Soil and water, SW-9

Activity	Condition for which design features applies	Design Feature	Resource Projected, FEIS Design Feature Number
Silviculture (cutting of hardwoods)	Summer roost period less than or greater than 5 miles from hibernaculum	<p>Unless mist net surveys, exit surveys or other surveys approved by the Fish and Wildlife Service are done prior to cutting to identify known roosting habitats for Indiana bat, any cutting of potential suitable roost trees must be done outside the summer roost period:</p> <ul style="list-style-type: none"> • Trees that are less than or equal to 5 miles from a hibernacula would be removed between November 16 and March 31. • Trees that are greater than 5 miles from a hibernacula would be removed between October 1 and March 31. 	Threatened and Endangered Bats, W-8
Silviculture (cutting of hardwoods)	All	<p>In order to ensure that undetected roosts are not affected, where large overstory hardwood trees would be removed, mist net surveys approved by the Fish and Wildlife Service must be done to identify known roosting habitat prior to harvest or cutting. In all shelterwood treatments, mature leave trees including mixtures of the following species preferred by the Indiana bat will be retained; silver maple (<i>Acer saccharinum</i>), bitternut hickory (<i>Carya cordiformis</i>), shellbark hickory (<i>Carya laciniosa</i>), shagbark hickory (<i>Carya ovata</i>), white ash (<i>Fraxinus Americana</i>), green ash (<i>Fraxinus pennsylvanica</i>), eastern cottonwood (<i>Populus deltoids</i>), white oak (<i>Quercus alba</i>), northern red oak (<i>Quercus rubra</i>), post oak (<i>Quercus stallata</i>), black locust (<i>Robinia pseudoacacia</i>), American elm (<i>Ulmus Americana</i>) and slippery elm (<i>Ulmus rubra</i>). (Refer to Forest Plan Biological Opinion pages 90 and 92 regarding required surveys for federally listed Indiana bats.)</p>	Threatened and Endangered Bats, W-9
Silviculture (skid trails)	All	Construct and maintain water-control structures to divert water off the skid-trails.	Soil and Water, SW-3
Silviculture (skid trails)	All	Designate skid-trails, reusing previous skid-trails and log-landings where feasible. Skid-trails will normally be less than 8-percent grade and avoid crossing streams when practical. Skid-trails and log-landings will be seeded and mulched as soon as practical after disturbance as needed.	Soil and Water, SW-5
Silviculture (skid trails)	Ephemeral, intermittent, or perennial streams	Refrain from skidding or winching downed trees across ephemeral, intermittent, or perennial streams, except at designated crossings to protect riparian and aquatic resources.	Soil and Water, SW-11
Silviculture (log landings)	Ohio river Scenic Biway, Azotus Road Road, Cave Springs Road, Midway Road, Poco Road, Rosebud Road, and Temple Hill Road	Establish log landings no closer than 300 feet from the Ohio River Scenic Byway (ORSB) and 150 feet from Azotus Road, Cave Springs Road, Midway Road, Poco Road, Rosebud Road, and Temple Hill Road. On the ORSB, restoration of the site must be done concurrently with, or immediately following activities; on all County roads, restoration of site must be accomplished within one year from completion of project.	Visuals, V-1

Activity	Condition for which design features applies	Design Feature	Resource Projected, FEIS Design Feature Number
Disturbance (including timber harvest, fireline construction)	Within 100 feet of cave or abandoned mine that is occupied by Indiana bat or gray bat	If a cave or abandoned mine is identified during implementation, significant disturbance (including timber harvest and fire line construction) would be prohibited within 100 feet of the cave entrance when occupied by bats (Indiana bat and gray bat).	Threatened and Endangered Bats, W-1
Timber harvest, prescribed burning	2-5 mile radius of known rattlesnake dens	Protect known rattlesnake dens from human disturbance. Maintain oak-hickory forests, including both early- and late-successional stages, and barrens habitats, as summer foraging habitats where they exist within a 2-to-5-mile radius of known den sites. Burning near known timber rattlesnake den locations will be done only during hibernation seasons when individuals are in dens. Exact timing of burns will be determined on a site-specific basis using the best available science at the time of implementation	Timber rattlesnake, W-14
Disturbance	Documented bald eagle nest	There are no known eagle nests within the project area. If a nest is documented during project implementation, the following will apply. <ul style="list-style-type: none"> • disturbance would be prohibited within 300 feet of each occupied eagle nest, • significant changes in the landscape would be prohibited within 600 feet of an occupied eagle nest, and management activities that could result in adverse disturbance to nesting birds would be restricted within 1,300 feet of an eagle nest during the nesting period. 	Bald eagle, W-15
Disturbance	Documented raptor nests	There are no known raptor nests. If an active hawk or owl nest is identified during project implementation, a wildlife biologist will evaluate the tree and identify nest buffers or treatment restrictions if necessary. No active nest trees will be removed between April 1 and August 31.	Raptors, W-16
Prescribed burning	All	Prescribed fire and wildland-fire use may be employed to accomplish oak and other species regeneration, hazardous fuels reduction, wildlife habitat management, ecological restoration, maintenance of fire-dependent plant communities, timber stand improvement, and other management objectives. Preference should be given to landscape-scale burns.	Fire, Fire-1
Prescribed burning	All	All management-ignited prescribed fires shall be carried out in accordance with the provisions of an approved burning plan. Smoke management planning must be used to control the effects of smoke emissions and meet air-quality standards. During prescribed fires, consideration shall be given to smoke-sensitive areas downwind of the burn.	Air quality, Fire-2
Prescribed burning	Archeological sites and historic properties	Archeological sites and other historic properties will be protected from prescribed fire project activities according previously agreed upon	Heritage, H-1

Activity	Condition for which design features applies	Design Feature	Resource Projected, FEIS Design Feature Number
		mitigation measured included in the Shawnee National Forest Prescribed Fires Programmatic Agreement.	
Prescribed burning	Within 0.25 mile of any Indiana bat or gray bat hibernacula (Brasher Cave)	Prescribed burns within 0.25 mile of any Indiana bat or gray bat hibernacula will be conducted under conditions that reduce or eliminate the dispersal of smoke into the known hibernacula (Brasher Cave).	Threatened and Endangered Bats, W-2
Prescribed burning	Upland or bottomland forest	For protection of the Indiana bat maternity roosts and bat foraging habitat, prescribed burning will occur at the following times: <ul style="list-style-type: none"> • Upland forest – September 2 to April 30; • Bottomland Forest – September 2 to March 31. 	Threatened and Endangered Bats, W-3
Prescribed burning	Within 100 feet of Brasher Cave	No burning may take place within 100 feet of Brasher Cave.	Threatened and Endangered Bats, W-4
Prescribed burning	Within 2.5 miles from a known hibernacula	For the protection of the Indiana bat roosting habitat, no more than 20 percent of the area within 2.5 miles of any known hibernacula would be burned (blackened) each year.	Threatened and Endangered Bats, W-4
Prescribed burning	Between 2.5 and 5 miles from a known hibernaculum	For the protection of the Indiana bat roosting habitat, no more than 50 percent of the area between 2.5 and 5 miles from any known hibernacula would be burned (blackened) each year.	Threatened and Endangered Bats, W-4
Prescribed burning	Areas treated with triclopyr in the previous 30 days	Because smoke residue level for triclopyr poses a slight risk, we would not apply fire to any vegetation treated with triclopyr in the previous 30 days.	Table 7, Herbicide safety
Prescribed burning	Rock outcroppings and cave entrances	In order to protect eastern small-footed bats. Rock outcroppings and cave entrances in the project area will not be intentionally ignited by burn crews. No firelines would be constructed in or immediately adjacent to cave habitat.	Threatened and Endangered Bats, W-13
Prescribed burning	Growing season burns	For the protection of the nests and nestlings of migratory birds, growing-season burns should be done as early or as late in the season as possible, preferably before April 15 and after August 1.	Migratory birds, W-17
Fireline	All	When possible, natural or existing features, such as streams, roads and trails, should be used as firebreaks. Construct hand lines where necessary to prevent unacceptable soil impacts on steep slopes or install erosion control features.	Soil and water, SW-12
Fireline	Wetland, riparian buffers and steep slopes	As a new fireline is being constructed, wetland, riparian buffers, and steep slopes would be flagged, and a lower-impact type of fireline would be constructed. This could include: <ul style="list-style-type: none"> • Hand line – an 18- to 40-inch-wide line is created, and fuels are removed using hand tools. These tools may include (but are not 	No number assigned in FEIS (see FEIS Volume 2, page 120)

Activity	Condition for which design features applies	Design Feature	Resource Projected, FEIS Design Feature Number
		<p>limited to) leaf rakes, leaf blowers, chainsaws, shovels, pulaskis, and council rakes.</p> <ul style="list-style-type: none"> Wet line – use of water to stop the forward spread of fire either by pretreating the fuels or extinguishing the leading edge of the fire. This method is often used where water can be pumped from a nearby source (stream) or access for an engine is available and the fuels are light, such as leaf litter or grass. 	
Fireline	Sensitive plant locations (RFSS)	When populations of RFSS cannot be completely avoided by firelines, use alternative methods to bulldozer lines such as the use of hand line, clearing with leaf blowers, and backfiring to reduce any soil disturbance.	Botany, B-5
Fireline	All	Snags (dead trees) may need to be removed either in or immediately adjacent to the fireline. We would take reasonable precautions to avoid impacts to standing dead trees and the wildlife that uses them. These might include actions such as excluding snags from the areas to be burned when constructing firelines, or raking around the base of the snag if the snags are inside a burn unit but close to the edge.	No number assigned in FEIS (see FEIS Volume 2, page 120)
Roadwork and hauling	All	Conduct soil and watershed improvements (water bars, water diversion structures, rock armoring at stream crossings) to existing NFS roads to reduce sediment loads into aquatic areas, restore and enhance healthy aquatic habitat conditions.	Soil and water, SW-10
Roadwork		Road and route improvements would be implemented using applicable best management practices, including those included in State of Illinois Forestry Best Management Practices and Forest Service National Best Management Practices for Water Quality Management on National Forest System Lands.	Transportation, T-1
Invasive plant treatments (mechanical, manual, and chemical)	All	Workers should inspect, remove and properly dispose of plant parts found on clothing and equipment before entering or leaving the project area.	No number assigned in FEIS (see FEIS Volume 2, page 131)
Herbicide application	All	Herbicides would be applied at or below label-recommended rates, using only those registered by the Environmental Protection Agency for the specific type of site and use proposed. All applicable State and Federal laws would be followed. Herbicides would be applied according to label directions and in accordance with the guidance published by the Illinois Nature Preserves Commission and The Nature Conservancy, best management practices and direction in the Forest Service Manual (2080, 2150 and 2200).	No number assigned in FEIS (see FEIS Volume 2, page 131)

Activity	Condition for which design features applies	Design Feature	Resource Projected, FEIS Design Feature Number
Herbicide application	All	Signs would be posted to alert the public to the location and types of treatments being done and the date when a treated area could be re-entered.	No number assigned in FEIS (see FEIS Volume 2, page 131)
Herbicide Application	All	Safe handling and application of herbicides ensures protection of the health and safety of employees and the public. Follow all safety and spill plan requirements and adhere to the following standards:	Table 7, Herbicide safety
Herbicide Application	Pre-application	<ul style="list-style-type: none"> • Use herbicides only when they will provide the most effective control relative to the potential hazards of other proposed methods and select the most effective herbicide requiring the least number of applications. • Follow the herbicide label directions carefully. This could include temporary closure of treatment areas to prevent or limit public exposure and ensure public health and safety. • Make all applications under the direction of a certified pesticide applicator. • Obtain weather forecasts prior to herbicide treatment and halt or delay treatment, if necessary, to prevent runoff during heavy rain or high wind. Apply herbicide only when wind speeds are less than 10 mph, or according to label direction, to minimize drift. • Appropriate protective gear will be worn by herbicide applicators. 	Table 7, Herbicide safety
Herbicide Application	During application	<ul style="list-style-type: none"> • Use the lowest pressure, largest droplet size, and largest volume of water permitted by the label to obtain treatment success; use lowest spray boom and release height possible consistent with operator safety. • Apply pesticides during periods of low visitor use when possible; areas treated with pesticides shall be signed, as appropriate, to ensure users are informed of possible exposure. • When treating invasives where runoff may easily enter the water table (i.e., streams, wetlands, caves, sink-holes, or springs), use only pesticides labeled for use in or near aquatic systems. 	Table 7, Herbicide safety
Herbicide Application	Post-application	<ul style="list-style-type: none"> • Store herbicides in approved buildings when not in use. • Wash and rinse equipment used in the mixing and application of pesticides in areas where runoff will not reach surface waters, wetlands, fens, sinkholes, or other special habitats. • Dispose of rinse water from cleaning or rinsing actions in conjunction with herbicide treatment according to the Federal Insecticide, 	Table 7, Herbicide safety

Activity	Condition for which design features applies	Design Feature	Resource Projected, FEIS Design Feature Number
		Fungicide and Rodenticide Act http://www.purdue.edu/dp/envirosoft/pest/src/container.htm . <ul style="list-style-type: none"> • Store or dispose of herbicide containers in accordance with label specifications. 	
Herbicide Application	All	Application of herbicides and other pesticides will be planned to avoid or minimize direct and indirect effects to known, occupied Threatened, Endangered, or Sensitive (TES) bat hibernacula and maternity roosts.	Threatened and Endangered Bats, W-12

The following BMPs taken from the *USDA National Best Management Practices for Water Quality Management on National Forest System Lands, Vol. 1 National Core BMP Technical Guide* were considered in the effects analysis for the three action alternatives proposed for the Hills Project.

Table 7. Best management practices to be implemented for the Hills Project

BMP Number	BMP Description
Plan 2_Project Planning and Analysis	Use the project planning, environmental analysis, and decision making processes to incorporate water quality management BMPs into project design and implementation.
Plan-3 Aquatic Management Zone Planning	To maintain and improve or restore the condition of land around and adjacent to waterbodies in the context of the environment in which they are located, recognizing their unique values and importance to water quality while implementing land and resource management activities.
AqEco-3. Ponds and Wetlands	Design and implement pond and wetlands projects in a manner that increases the potential for success in meeting project objectives and avoids, minimizes, or mitigates adverse effects to soil, water quality, and riparian resources.
AqEco-4. Stream Channels and Shorelines	Design and implement stream channel and lake shoreline projects in a manner that increases the potential for success in meeting project objectives and avoids, minimizes, or mitigates adverse effects to soil, water quality, and riparian resources.
Chem-1. Chemical Use Planning	Use the planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from chemical use on NFS lands.
Chem-2. Follow Label Directions	Avoid or minimize the risk of soil and surface water or groundwater contamination by complying with all label instructions and restrictions required for legal use.
Chem-3. Chemical Use Near Waterbodies	Avoid or minimize the risk of chemical delivery to surface water or groundwater when treating areas near waterbodies
Chem-4. Chemical Use in Waterbodies	Avoid, minimize, or mitigate unintended adverse effects to water quality from chemical treatments applied directly to waterbodies.
Chem-5. Chemical Handling and Disposal	Avoid or minimize water and soil contamination when transporting, storing, preparing and mixing chemicals; cleaning application equipment; and cleaning or disposing chemical containers.
Chem-6. Chemical Application Monitoring and Evaluation	Determine whether chemicals have been applied safely, have been restricted to intended targets, and have not resulted in unexpected non-target effects and document and provide early warning of possible hazardous conditions resulting from potential contamination of water or other non-target resources or areas by chemicals.
Fire-2. Use of Prescribed Fire	Avoid, minimize, or mitigate adverse effects of prescribed fire and associated activities on soil, water quality, and riparian resources that may result from excessive soil disturbance as well as inputs of ash, sediment, nutrients, and debris.
Road-2. Road Location and Design	Locate and design roads to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.
Road-3. Road Construction and Reconstruction	Avoid or minimize adverse effects to soil, water quality, and riparian resources from erosion, sediment, and other pollutant delivery during road construction or reconstruction.
Road-4. Road Operations and Maintenance	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling road use and operations and providing adequate and appropriate maintenance to minimize sediment production and other pollutants during the useful life of the road.
Road-7. Stream Crossings	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when constructing, reconstructing, or maintaining temporary and permanent water-body crossings.

BMP Number	BMP Description
Road-10. Equipment Refueling and Servicing	Avoid or minimize adverse effects to soil, water quality, and riparian resources from fuels, lubricants, cleaners, and other harmful materials discharging into nearby surface waters or infiltrating through soils to contaminate groundwater resources during equipment refueling and servicing activities.
Veg-1. Vegetation Management Planning	Use the applicable vegetation management planning processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during mechanical vegetation treatment activities.
Veg-2. Erosion Prevention and Control	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by implementing measures to control surface erosion, gully formation, mass slope failure, and resulting sediment movement before, during, and after mechanical vegetation treatments.
Veg-3. Aquatic Management Zones	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when conducting mechanical vegetation treatment activities in the AMZ.

BMPs that address timber harvesting, streamside management zones, forest roads (including construction, reconstruction, maintenance, and stream crossings), prescribed burning, wetlands, and chemical use taken from the *Forestry Best Management Practices for Illinois* (State of Illinois 2007) were also considered in the effects analysis for the three action alternatives proposed for the Cretaceous Hills Ecological Restoration Project. This document can be found in the hydrology planning record.

There is overlap between the *USDA National Best Management Practices for Water Quality Management on National Forest System Lands, Vol. 1 National Core BMP Technical Guide* and the *Forestry Best Management Practices for Illinois*. We considered both documents in planning this project to ensure that the direction in the 2006 Shawnee LRMP is followed as well as the direction from the Forest Service to implement the National Corp BMPs. The analysis assumes BMPs would be applied consistent with the Forest Service Core BMPs and State of Illinois BMPs. After the Record of Decision is signed and prior to implementation of this project, we will finalize an implementation guide that will include BMPs from table 2, and the *Forestry Best Management Practices for Illinois*.

Monitoring Requirements

Forest Management

Vegetative monitoring would be completed as follows.

1. **To ensure that stands are adequately stocked within five years after regeneration harvests as required by National Forest Management Act.** Based on local experience, stands are expected to naturally regenerate successfully; however, there is some uncertainty associated with impact of the non-native invasive grass, Nepalese browntop (*Microstegium vimineum*) and other invasive species.

According to the Forest Plan, stocking surveys shall be made the first and third years after regeneration efforts (shelterwood, seed-tree, or clearcut harvesting) (USDA Forest Service 2006, p. 39). Minimum acceptable stocking in regenerated stands shall be identified in silvicultural prescriptions for specific stands. Depending on stocking survey results, site preparation and/or planting could be necessary. Artificial regeneration should be used when the conditions necessary for natural regeneration are not present, or when it is needed to maintain or restore desired species composition. Site-preparation may be required before planting when competition problems exist, such as when the predominant vegetation is a dense cover of briars, vines, scattered brush and small trees; or when heavy turf or dense weeds are present over more than 50 percent of the area. Browse control

may also be necessary for successful regeneration, establishment, and growth of desirable tree species.

2. To determine if a stand is stocked with hardwoods and, therefore, ready for the second entry (commercial thinning) to remove all remaining pine.

Following the shelterwood establishment cut, the overstory should be removed 5 to 10 years after the advanced regeneration is determined to be adequate (USDA Forest Service 2006, p. 153). We anticipate that the commercial thinning would, therefore, occur 10 to 20 years after the initial entry (after the shelterwood establishment cut). Monitoring must identify when advanced regeneration is adequate. Given a primary objective of restoring native hardwood forest (rather than maximizing oak regeneration) and to avoid creating openings, advanced regeneration would be considered adequate when stands contain more than 30 square feet per acre hardwood basal area (after accounting for logging damage anticipated during the subsequent commercial thinning). For example, if 10 square feet of hardwood basal area is expected to be lost during the commercial thinning, then stocking would be considered adequate when the mean stand hardwood basal area is more than 40 square feet per acre and we would schedule the commercial thinning for 5 to 10 years after this stocking is achieved.

3. To ascertain the need for herbicide control of pine regeneration subsequent to any mechanical or burn treatments in pine units.

Herbicide treatment of pine seedlings would be intended to prevent any pine seedlings from surviving long enough to join the midstory and overstory. Treatment of even a single stem may be justified if weeds are being treated in the immediate vicinity. In areas removed from other ongoing herbicide treatments, monitoring would help managers determine whether the pine seedlings are dying out in the understory or if they are surviving to potentially join the midstory and overstory, in which case herbicide treatment would be necessary.

4. To determine composition and structure of regeneration and advanced regeneration for purposes of adapting treatments.

For example, if Nepalese browntop *excessively* impacts competition with oak regeneration, then we would re-evaluate the timing or sequence of invasive plant herbicide treatment.

Prescribed Fire

We would monitor treatment units and reapply prescribed fire based on monitoring results. Examples of factors that would be considered include:

- Time interval since last prescribed burn,
- Time of year when prescribed burning occurred,
- Fire intensity and duration,
- Impacts and effects on vegetation (including tree species composition),
- Impacts to invasives, and
- Smoke outputs.

We would implement subsequent prescribed burning as feasible to maximize and maintain treatment effectiveness and incorporate monitoring results.

We divided the project area into logical burn blocks. Where possible, burn blocks use roads, streams, and other features such as rights-of-way. Some fireline may need to be constructed. Numerous stands may comprise these burn blocks. Some stands are hardwoods where no harvesting will take place, some stands are pine units where no harvesting will take place, and some stands are pine units where harvesting will take place.

1. **Fuels monitoring would be completed as follows:** Prescribed fire burn blocks would be evaluated after burn completion, and fire effects would be noted in the prescribed burn plan to determine if objectives were met. Before implementing a follow-up burn in the same block, we would conduct a walkthrough after leaf and /or needle drop to assess the burn block's ability to carry a prescribed fire.
2. Subsequent prescribed burn entry in forested stands with an overstory present would be triggered by a minimum of 1.5 tons per acre in surface litter and 1.5 inches of surface litter depth, evenly distributed throughout the block. The amount (in tons per acre) and depth (in inches) of surface material (primarily leaf litter or needle cast) in hardwood or pine stands with an overstory present would be estimated using the **Digital Photo Series** (<http://depts.washington.edu/nwfire/dps/>).
3. We would assess harvested pine units where the overstory has been drastically reduced or eliminated to determine the amount of activity fuel remaining on the site (tons per acre) combined with surface fuel accumulated on the site as a response to harvest and prescribed fire activity. In these stands, we would consider total unit biomass as well as distribution within the unit. A minimum of 9 tons per acre in total unit biomass evenly distributed throughout the unit would trigger conditions conducive to a subsequent burn.

Table 21 displays fuels monitoring criteria for subsequent burning.

Table 8. Fuel monitoring triggers for subsequent entries

Forest or Stand Condition	Minimum Tons per Acre in Surface Litter	Minimum Surface Litter Depth	Digital Photo Series Equivalent
Hardwood	1.5 tons per acre	1.5 inches	MO2, MO3
Pine Unit – unharvested or lightly harvested	1.6 tons per acre	0.6 inches	MP01, MP11
Pine Unit – overstory has been drastically reduced or eliminated	N/A	N/A	< TP01

Once we achieve the desired landscape effects as shown by desired stand composition and structure (restoration), a shift to a maintenance burning interval and intensity would be possible. This most likely would be a less intense and less frequent application of prescribed fire. As implied earlier, this shift to maintenance-type prescribed burning would likely be 15 years or more from the initial restoration application of prescribed fire and could take several decades.

Invasive Species

Monitoring and evaluation entail comparing results being achieved to those projected in the Forest Plan and project-level effects analysis. They provide the decision maker and the public with information on the progress and results of project implementation. We would survey samples of the project area to assess invasive species increase or decrease. Additionally, we would make an assessment to ensure that design criteria were implemented correctly, including effects to non-target species. Follow-up treatment of invasives would be triggered by the continuing presence of the species in treated occurrences.

Invasive plant treatments will be monitored including, location, acres and effectiveness. If objectives are not being met, adjust treatment strategies. We would monitor to ensure native vegetation is re-established on a treated site after removing the invasive species and reseeding and/or planting native species if necessary to repopulate the site.

Transportation

Assess road maintenance, construction, or reconstruction to determine if design criteria and Forest Service best management practices are being correctly implemented. Determine the extent to which transportation system improvements achieve Forest Plan goals for administrative and public access in the analysis area.

Compliance Monitoring

The Forest Plan (page 16) estimates that pine stand conversions to hardwoods could produce about 3.6 million board feet per year during the first decade (2006–2015) of the Forest Plan. Thereafter, it is estimated that the annual output from the same activities would increase to 5.2 million board feet (USDA Forest Service 2006, pp. 16 and 25). In contrast, proposed initial treatments could yield approximately 45 million board feet.

Tracking Changed Conditions/Circumstances

The project will be implemented as described in the decision document (and repeated here in this implementation guide), including application of design features and best management practices. However, during the life of the project new information or changed circumstances may require additional review or consideration. A couple of examples of changed circumstances would be a new species being listed as threatened and endangered, or changed conditions in the project area due to a wind storm.

New information should be received following the process outlined in the Forest Service Handbook 1909.15 Chapter 18. An interdisciplinary review should be conducted to determine to whether or not the new information or changed circumstances are within the scope and range of the effects considered in the original analysis (i.e. the Final Environmental Impact Statement, and supporting reports). The review would also determine whether or not a correction, supplement, or revision of the EIS and Decision is necessary. The findings of such a review can be documented in a supplemental information report (SIR). However, a SIR is not a NEPA document and therefore, cannot fulfill the requirements of a supplement EIS. If the Responsible Official determines that there is a need to supplement or revise the analysis, then FSH 1909.15 Section 18.2, which provides direction for supplemental EIS, would be followed.

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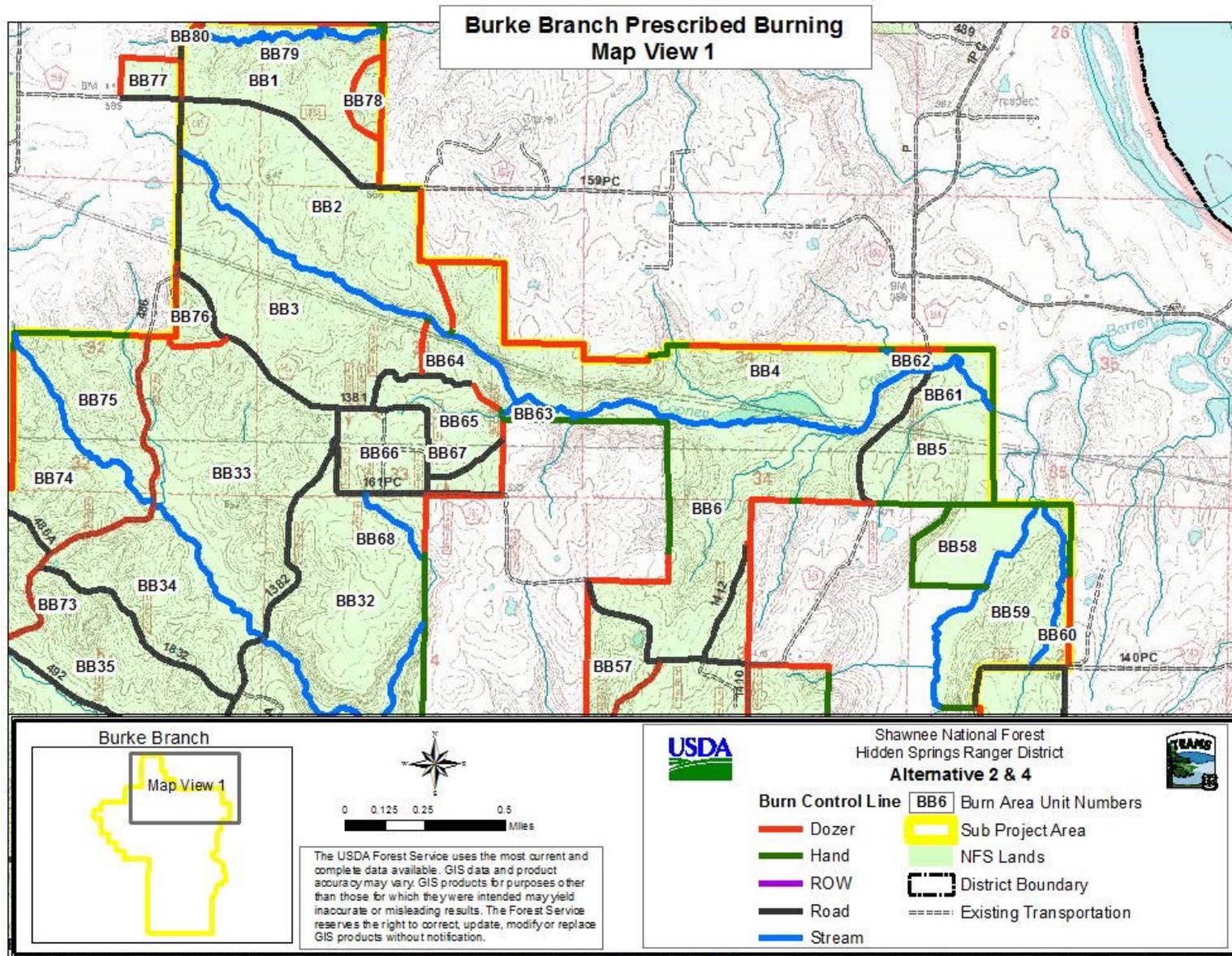


Figure 6. Burke Branch prescribed burning map view 1

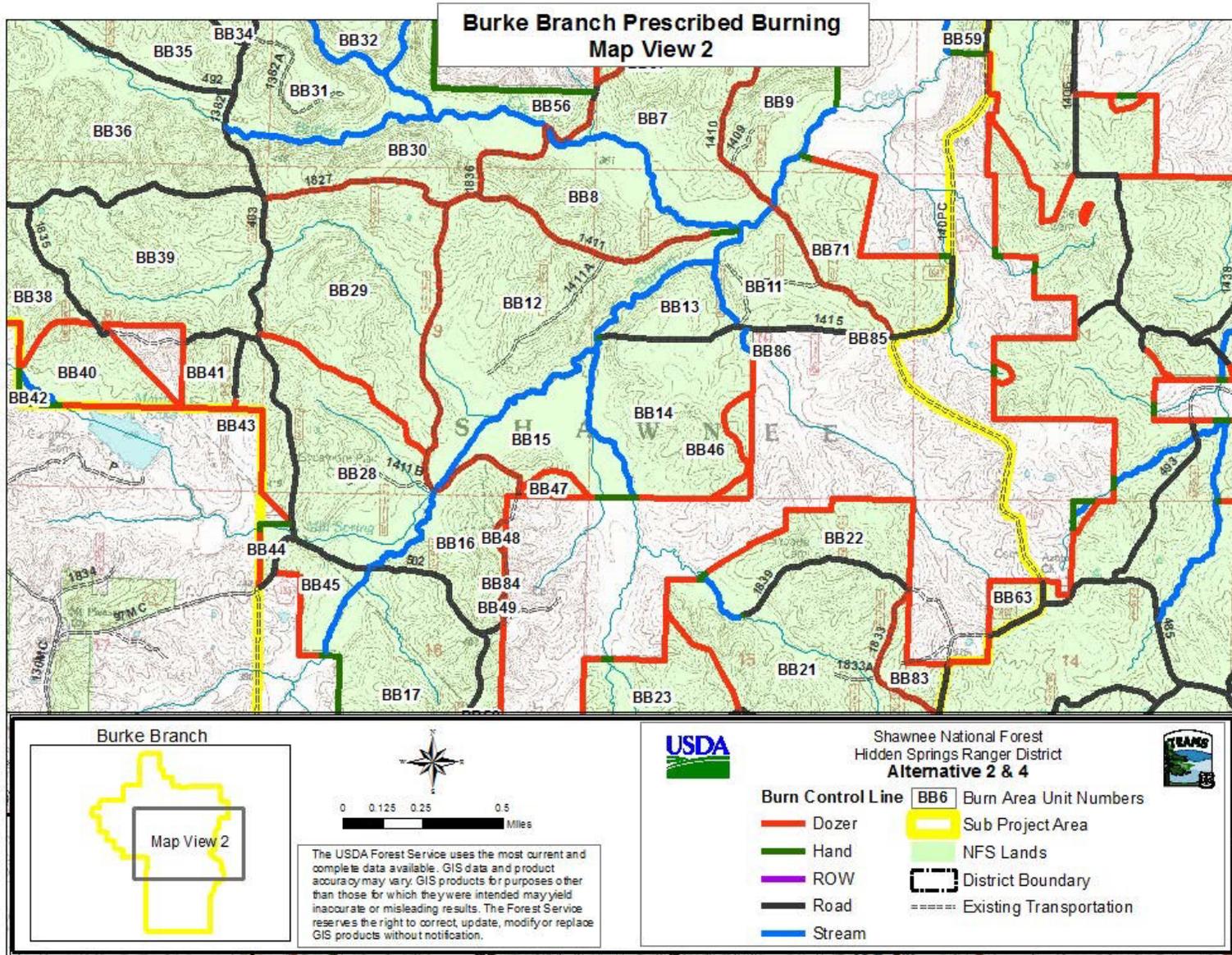


Figure 7. Burke Branch prescribed burning map view 2

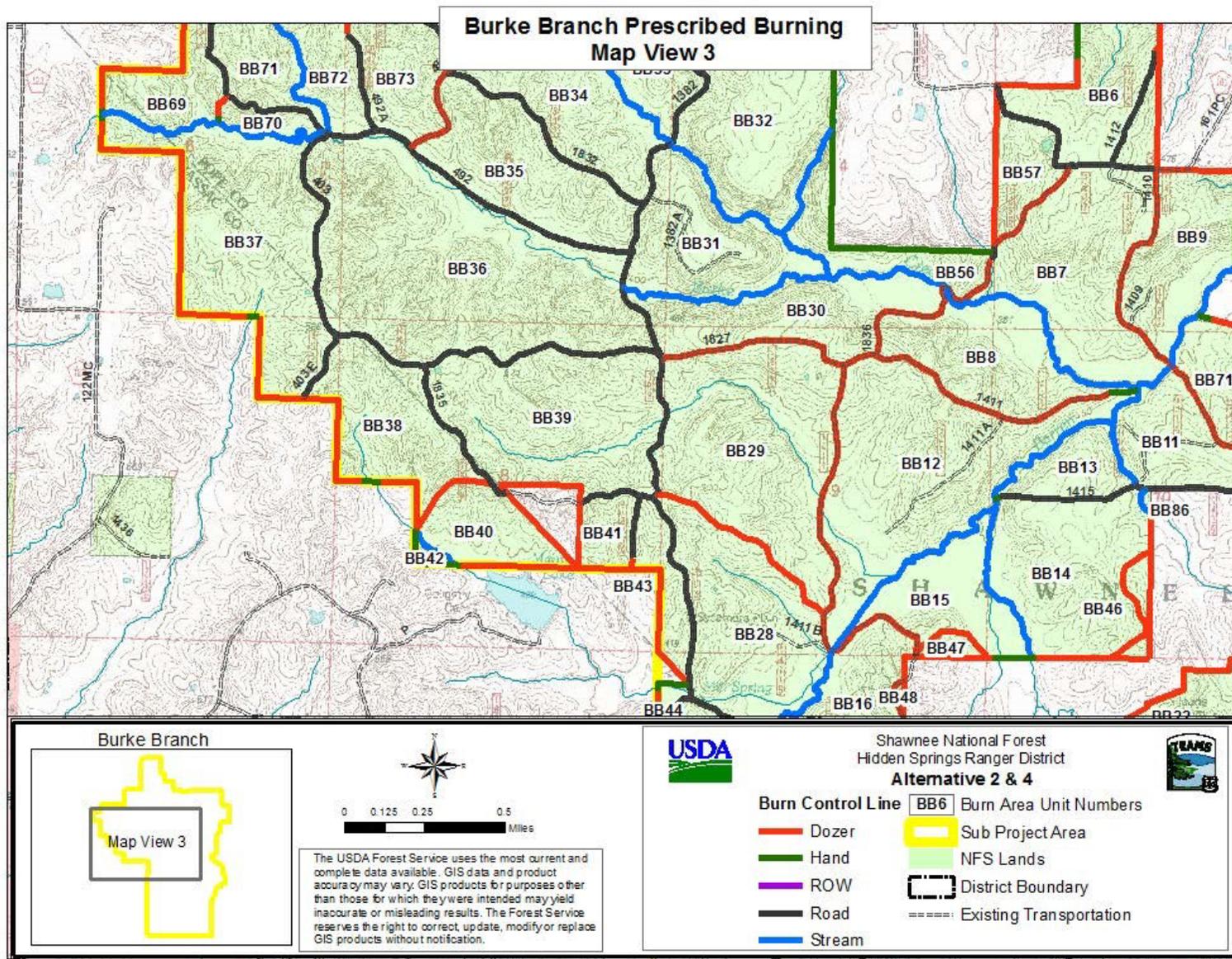


Figure 8. Burke Branch prescribed burning map view 3

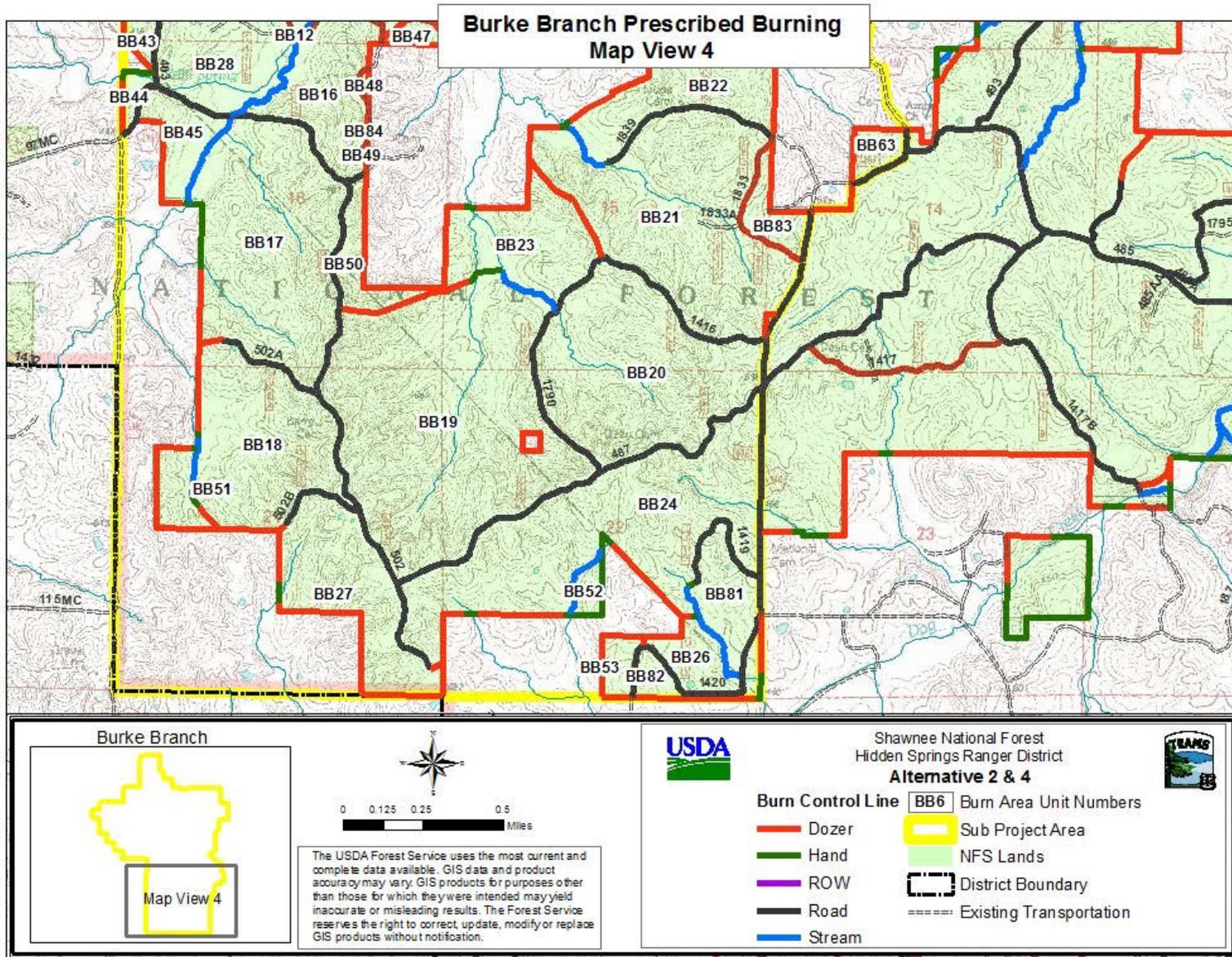


Figure 9. Burke Branch prescribed burning map view 4

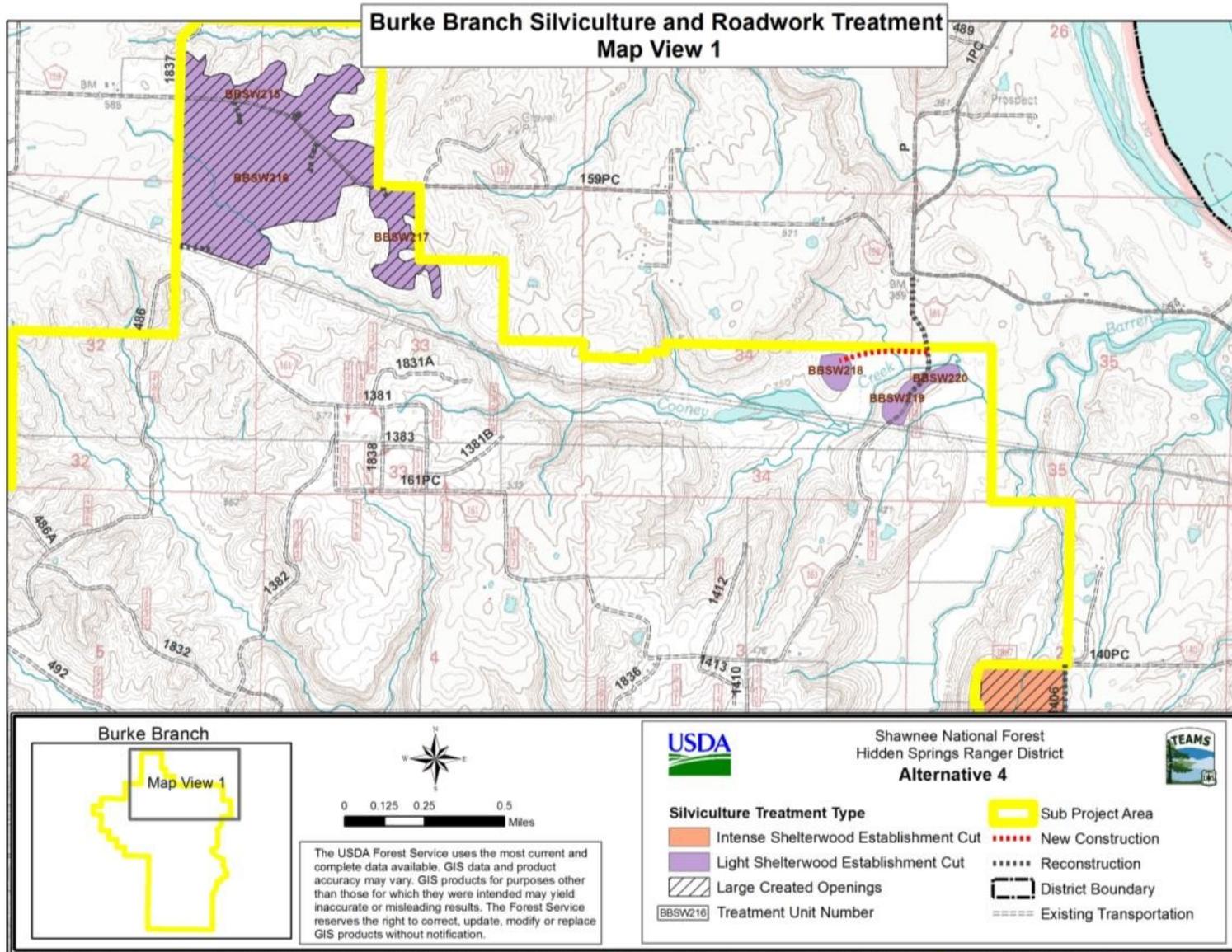


Figure 10. Burke Branch silviculture and roadwork treatment map view 1

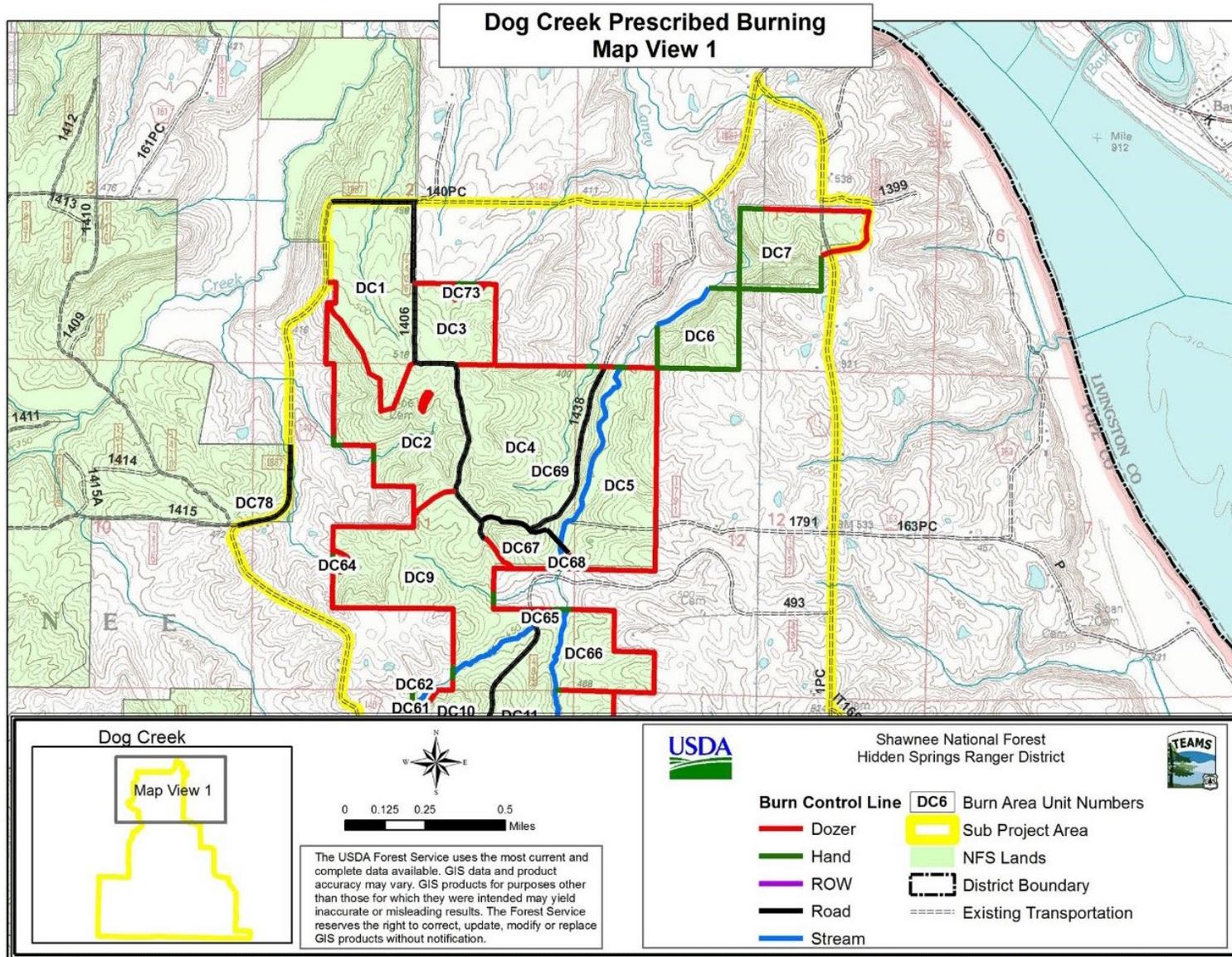


Figure 11. Dog Creek prescribed burning map view 1

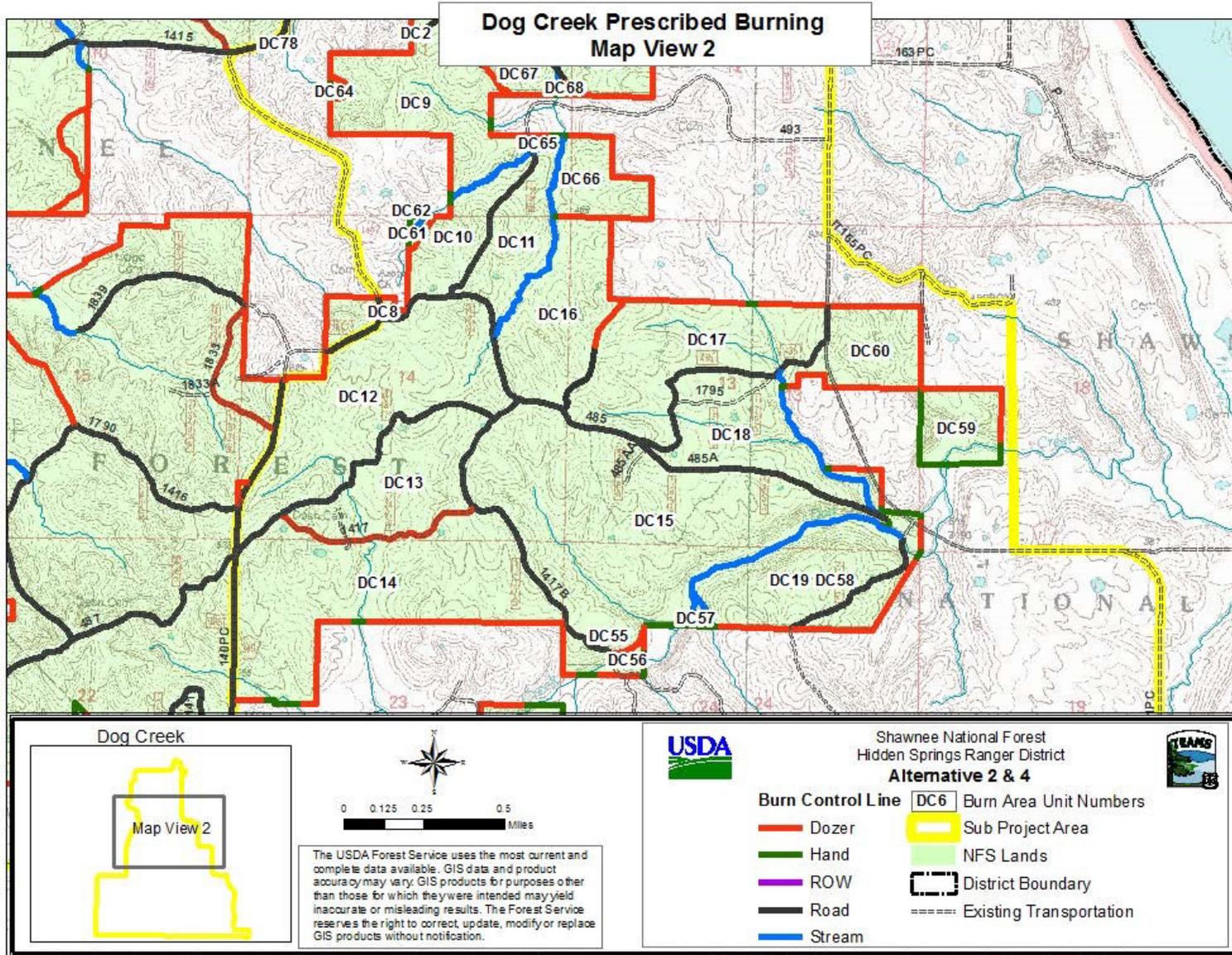


Figure 12. Dog Creek prescribed burning map view 2

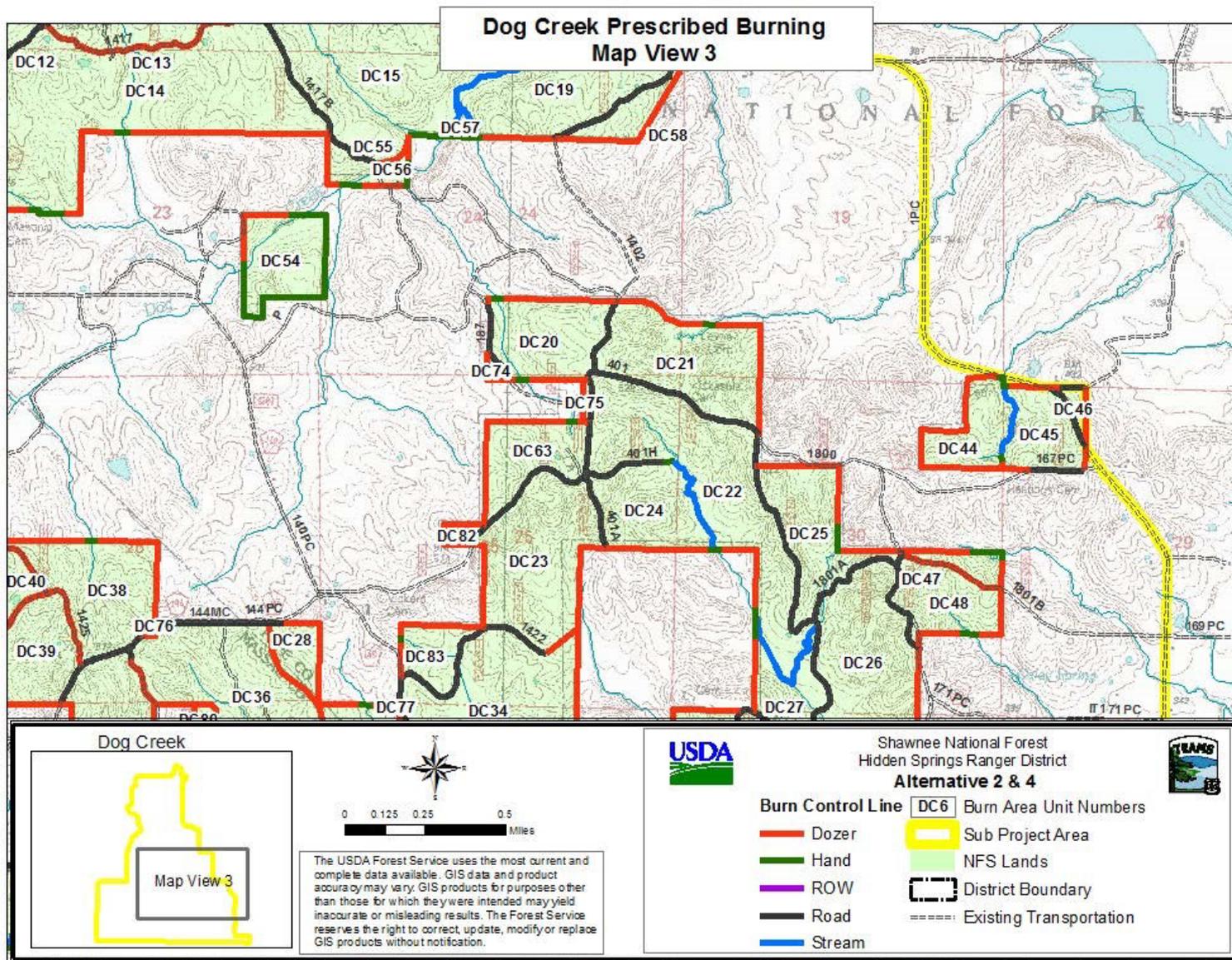


Figure 13. Dog Creek prescribed burning map view 3

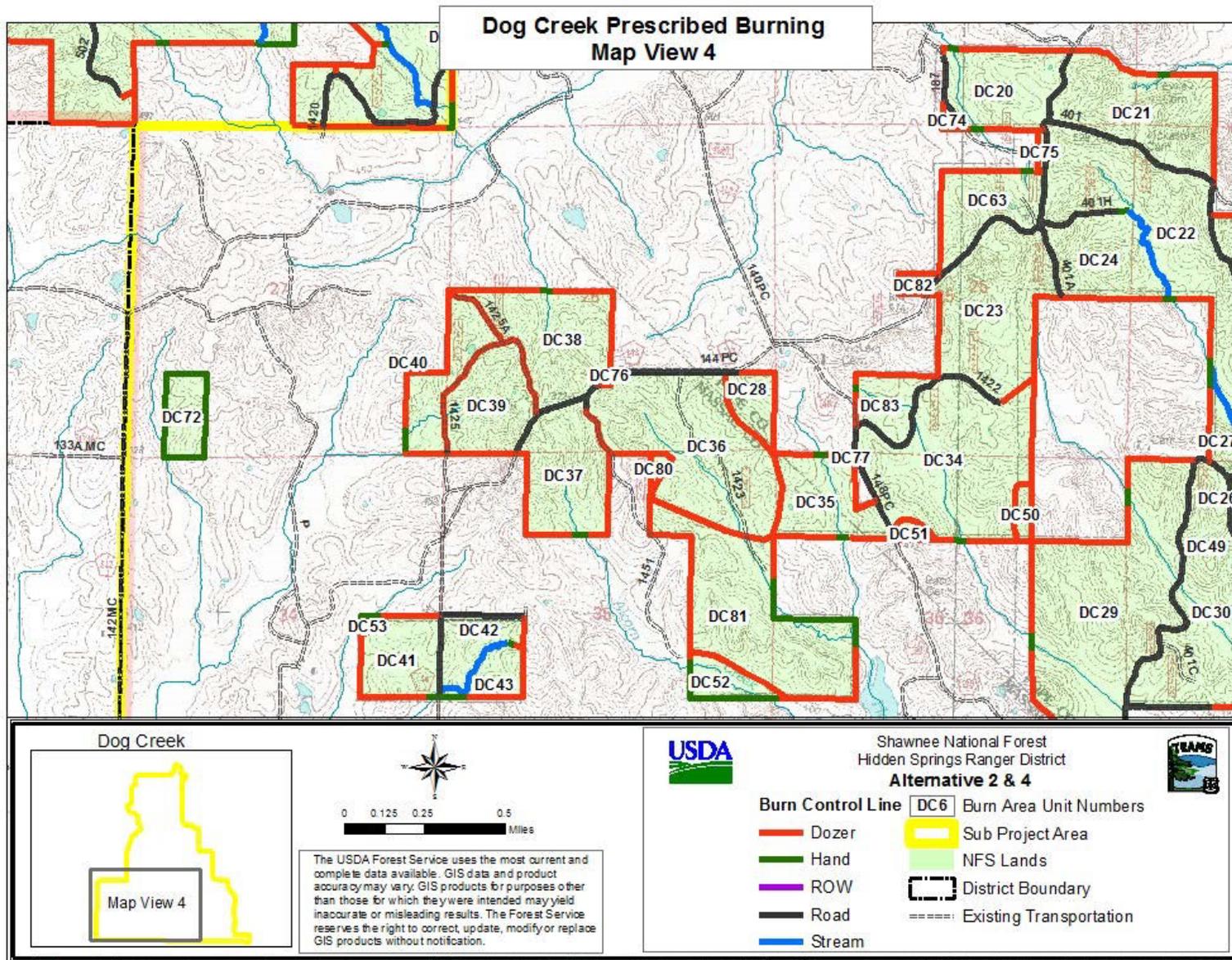


Figure 14. Dog Creek prescribed burning map view 4

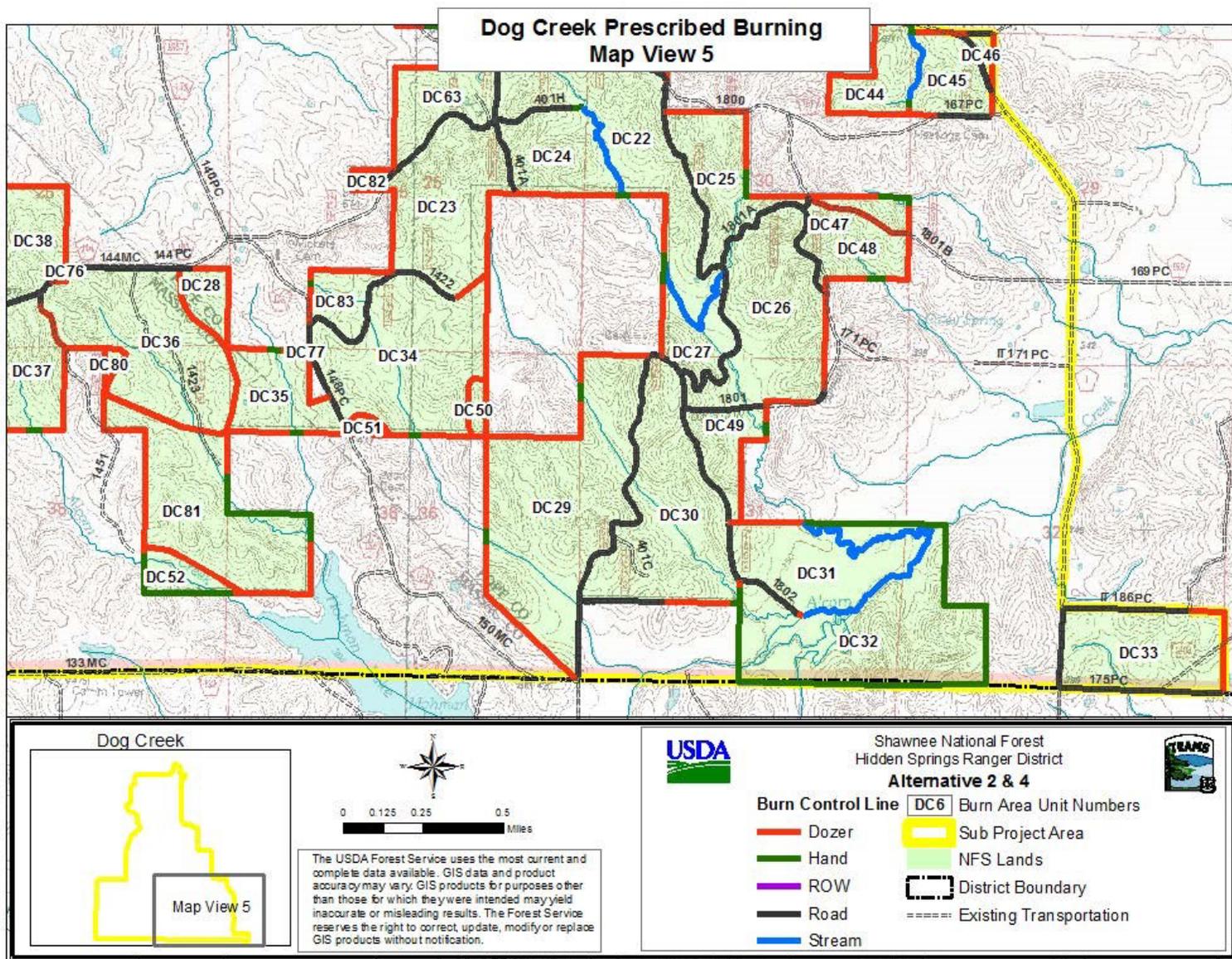


Figure 15. Dog Creek prescribed burning map view 5

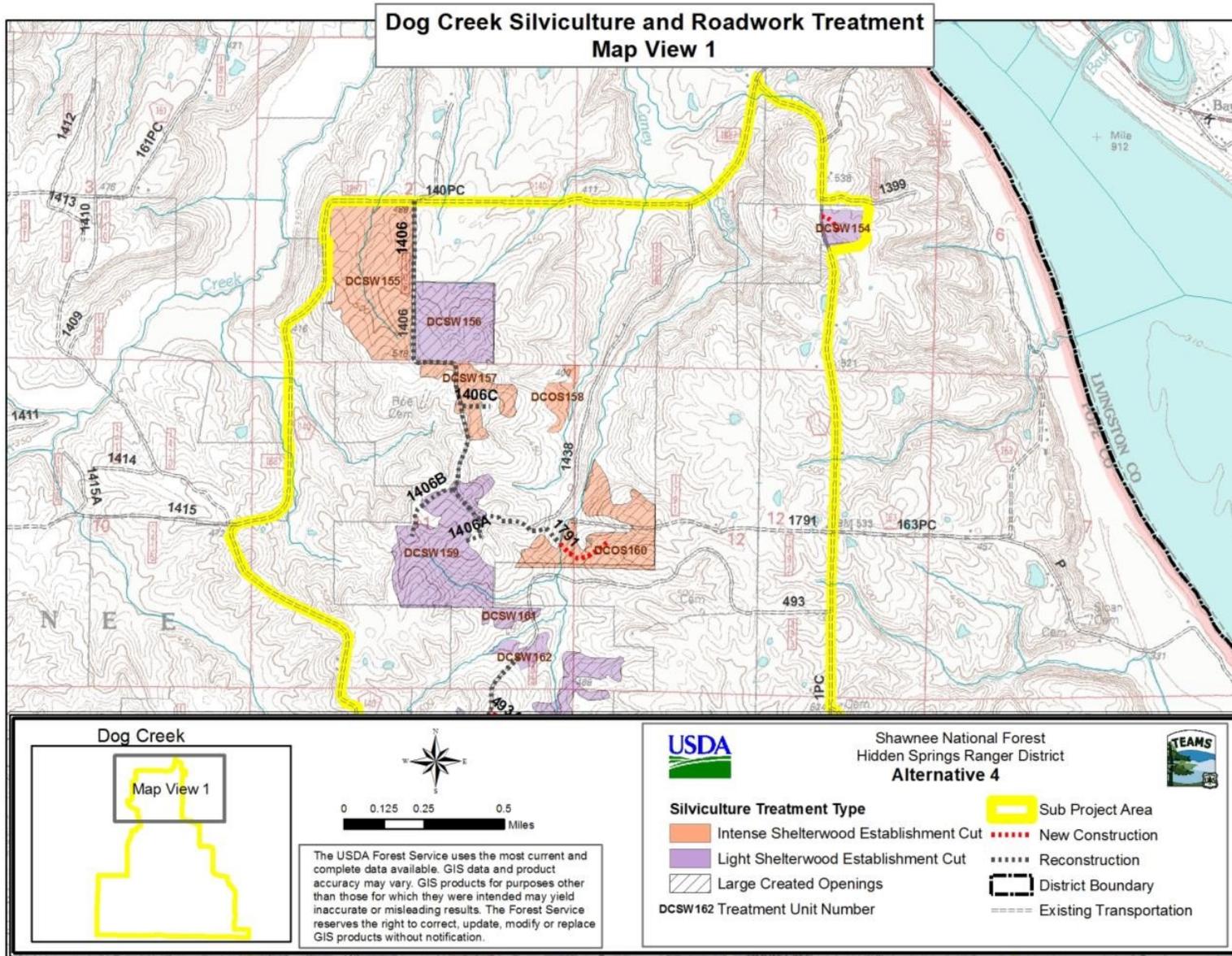


Figure 16. Dog Creek silviculture and roadwork treatment map view 1

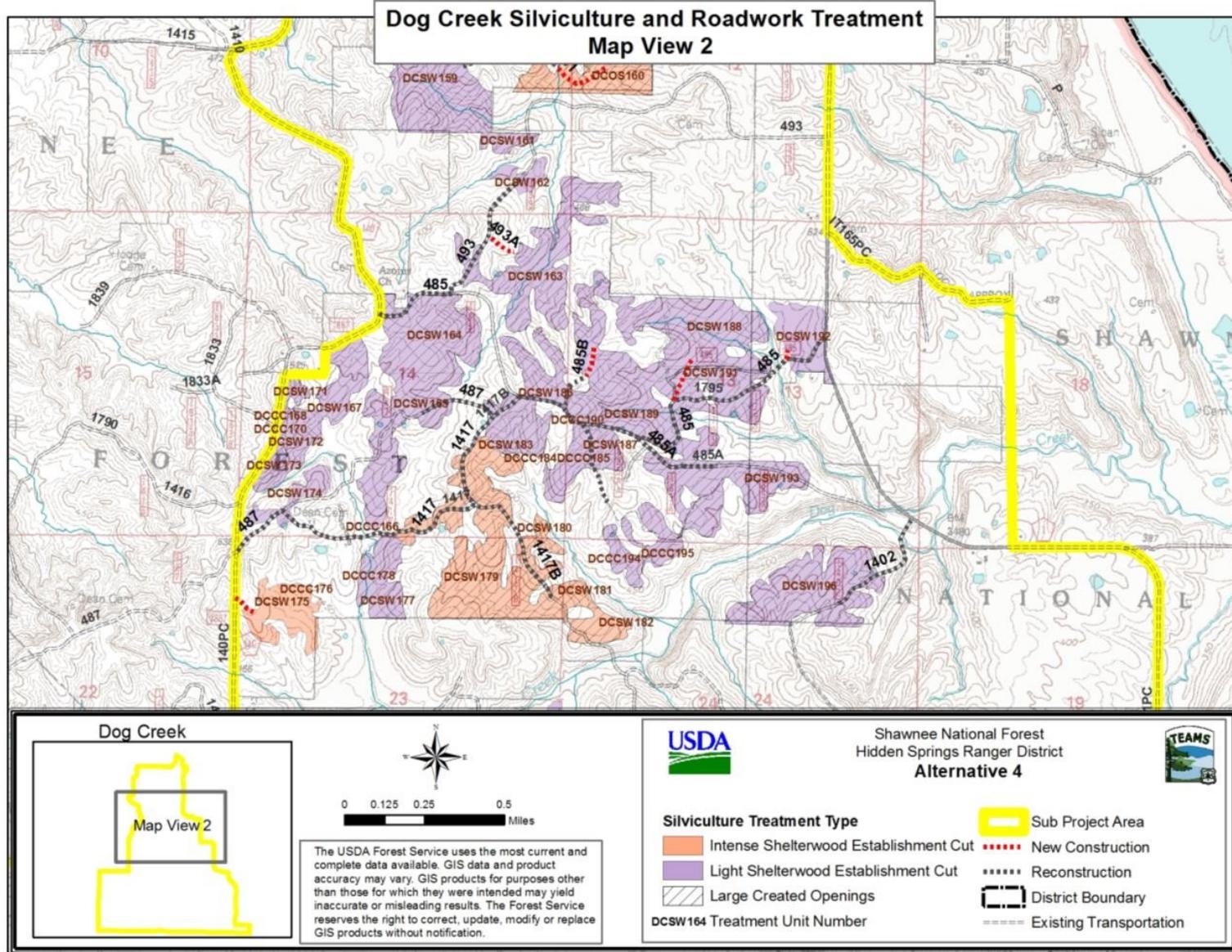


Figure 17. Dog Creek silviculture and roadwork treatment map view 2

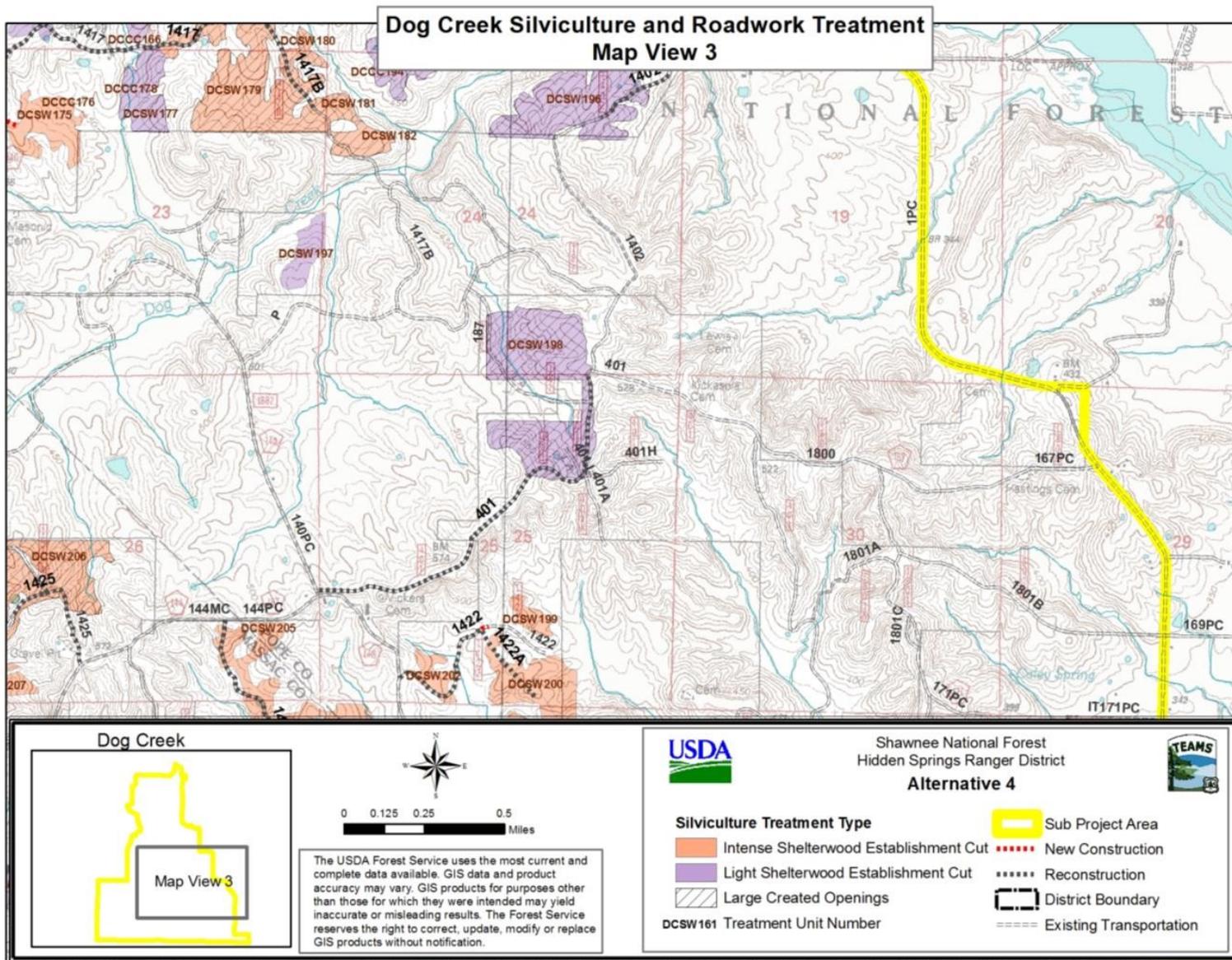


Figure 18. Dog Creek silviculture and roadwork treatment map view 3

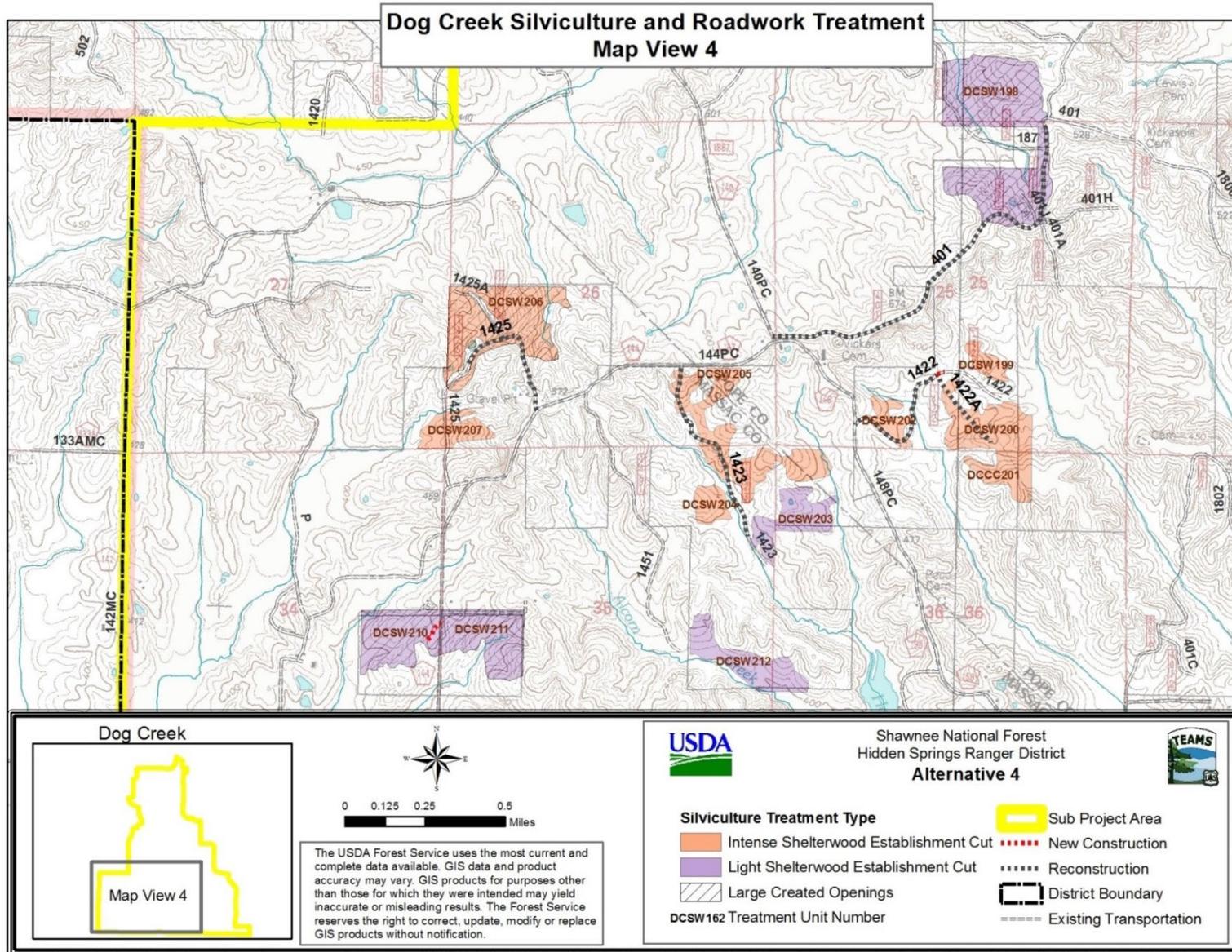


Figure 19. Dog Creek silviculture and roadwork treatment map view 4

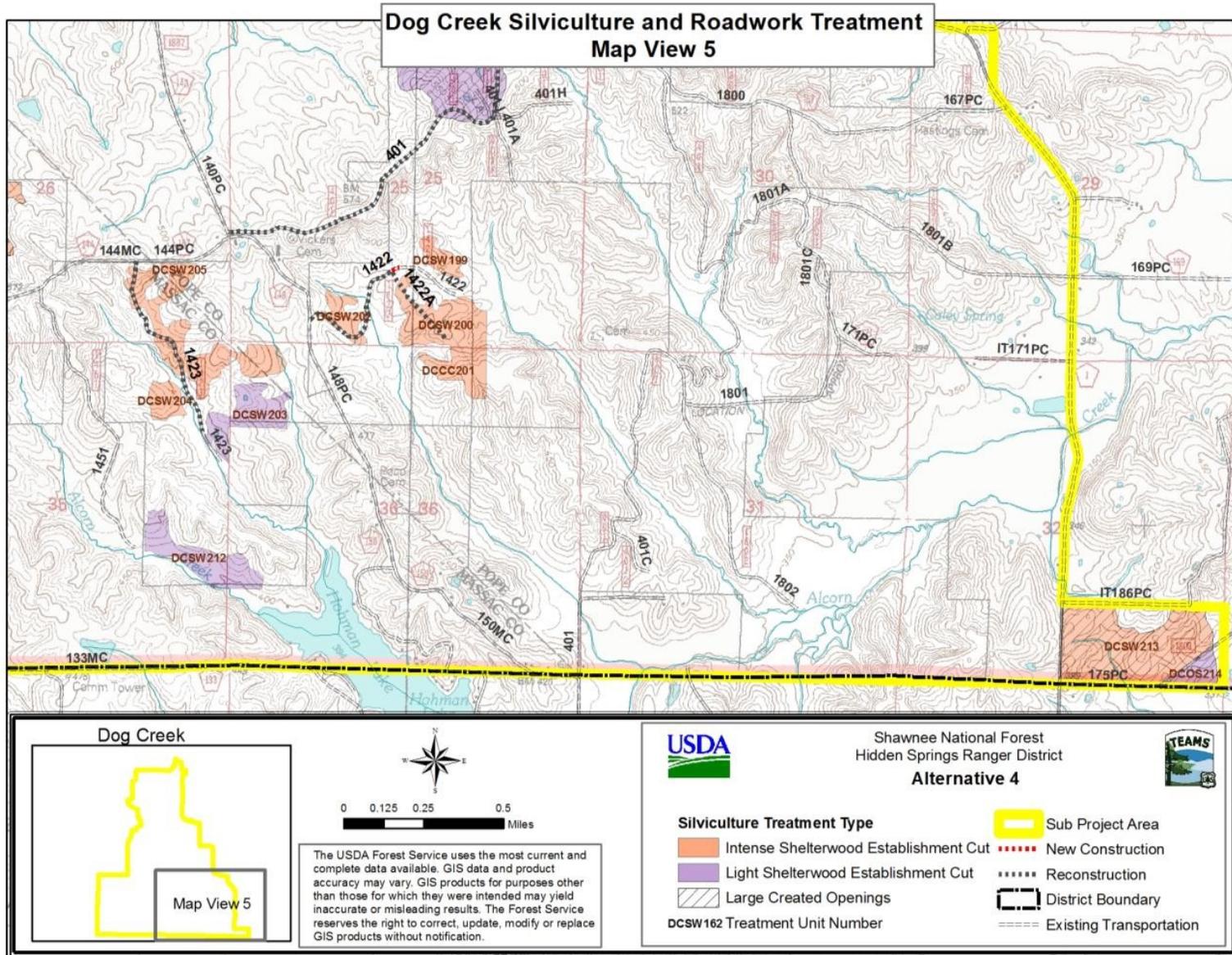


Figure 20. Dog Creek silviculture and roadwork treatment map view 5

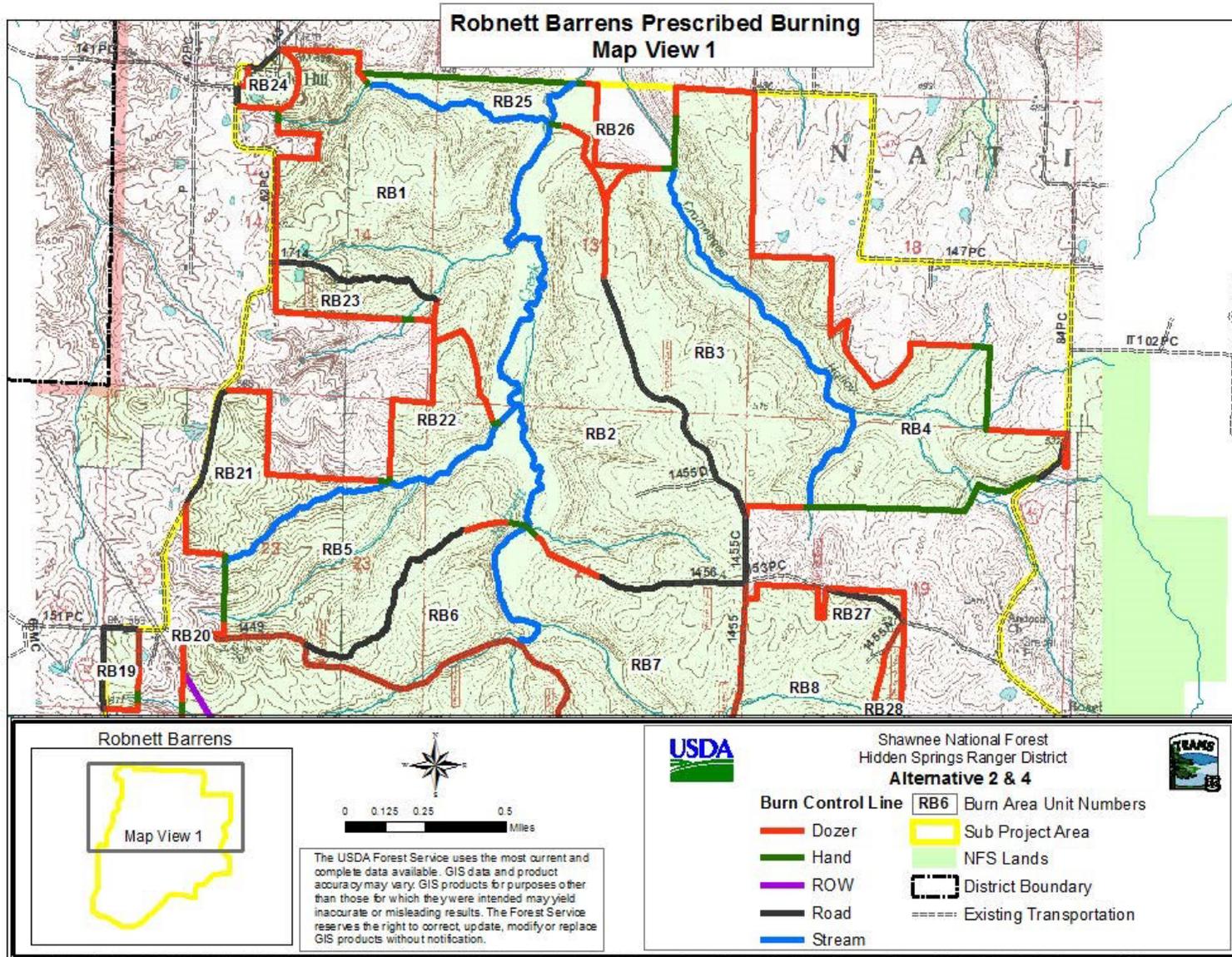


Figure 21. Robnett Barrens prescribed burning map view 1

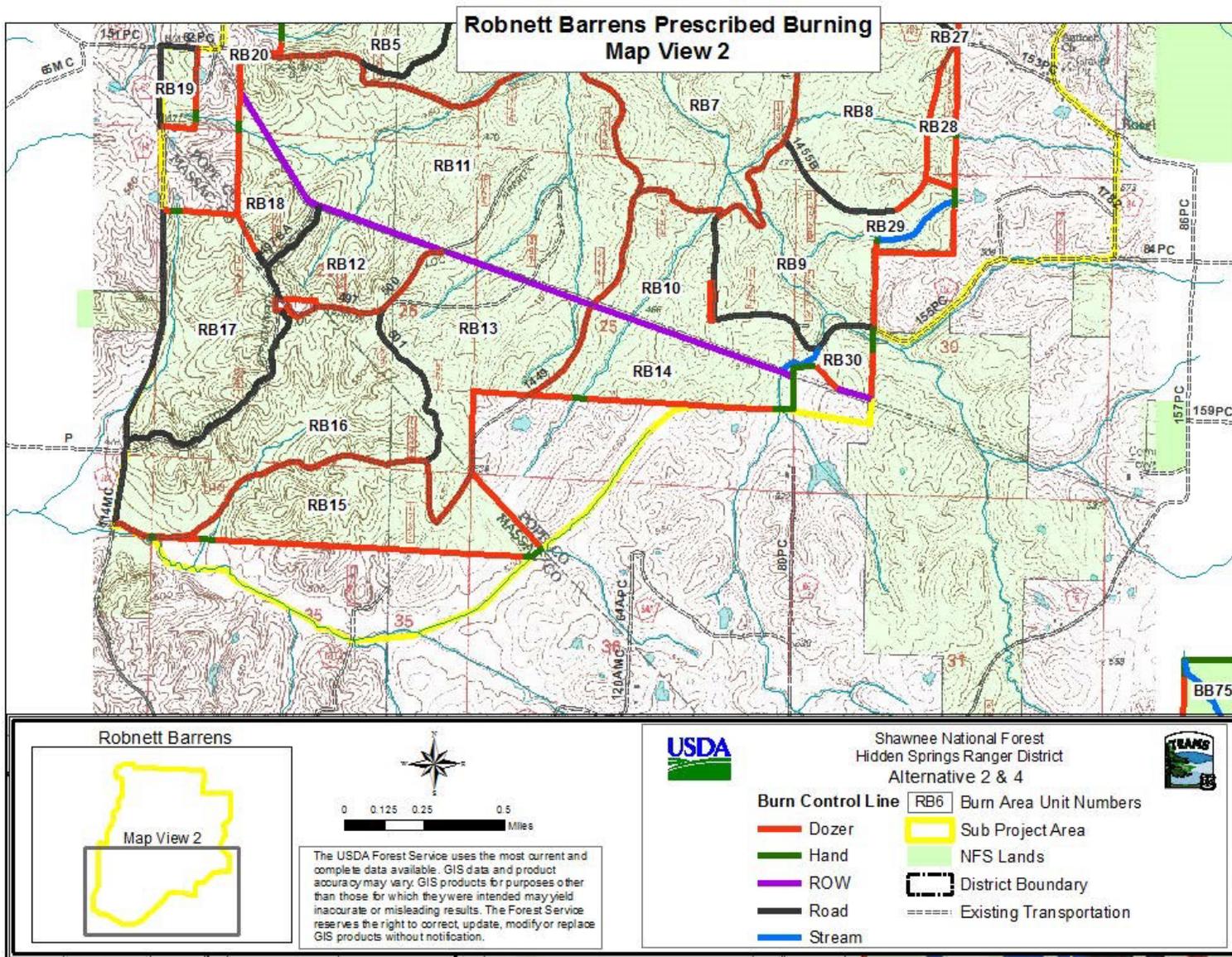


Figure 22. Robnett Barrens prescribed burning map view 2

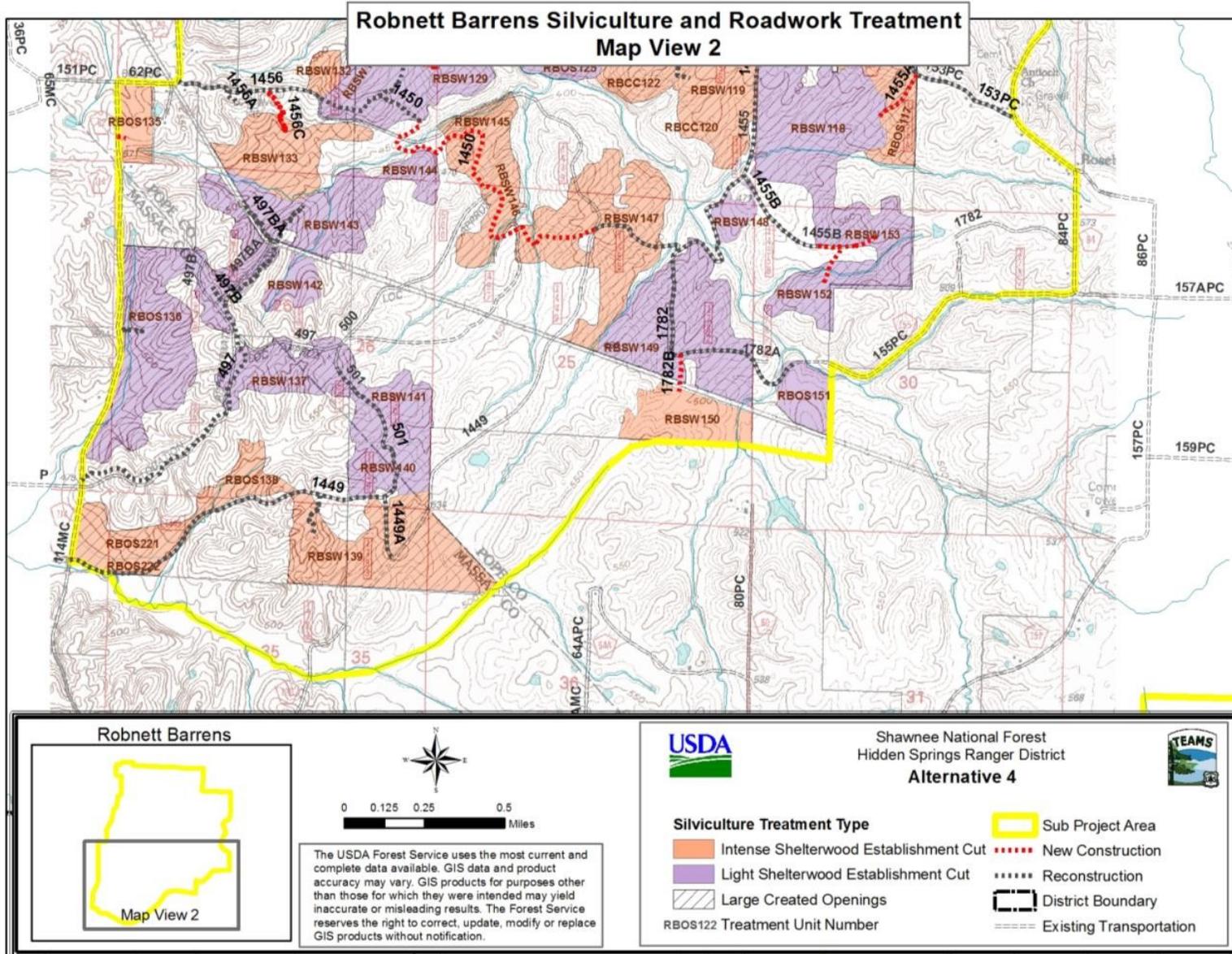


Figure 24. Robnett Barrens silviculture and roadwork treatment map view 2

Appendix B – Pine Unit Mechanical Treatments

Treatment unit size is provided to the nearest tenth of an acre; however, these figures are approximate. Treatment type may be adjusted based on updated stand condition data at the time of treatment. Final unit-specific treatment assignments would be made by the District after completion of silviculture prescriptions.

Table 9: Pine unit condition data (as of 2011) and initial treatment type

FSVeg Compartment	FSVeg Stand	Treatment Unit Number	Area (acres)	2011 TPA Oak w/ Height 2.0-4.5 ft (≥ 400)	2011 TPA Oak w/ Height ≥ 4.5 ft (≥ 100)	Intense or Light Shelterwood Treatment	Pre-Treatment Number of Pine Trees per Acre	Oak TPA ≥ 0.5 inches dbh	Hickory TPA ≥ 0.5 inches dbh	Oak and Hickory TPA ≥ 0.5 inches dbh
71	5	101	24.7	50	250	Intense	7	250	59	309
71	1	102	4.1	0	9	Light	1	9	0	9
71	2	103	21.0	0	108	Intense	74	108	64	172
72	17	104	12.3	0	0	Light	89	0	0	0
71	9	105	16.8	0	15	Light	0	15	25	40
71	11	106	10.5	0	9	Light	49	9	0	9
72	35	107	21.0	0	18	Light	41	18	0	18
72	14	108	48.6	0	18	Light	41	18	0	18
72	14	109	3.2	0	18	Light	41	18	0	18
72	38	110	24.1	0	829	Intense	297	829	0	829
72	24	111	106.3	0	0	Light	248	0	0	0
72	27	112	18.2	0	0	Light	42	0	0	0
72	31	113	9.0	0	400	Intense	154	0	0	0
72	28	114	35.1	0	0	Light	5	0	0	0

FSVeg Compartment	FSVeg Stand	Treatment Unit Number	Area (acres)	2011 TPA Oak w/ Height 2.0-4.5 ft (≥ 400)	2011 TPA Oak w/ Height ≥ 4.5 ft (≥ 100)	Intense or Light Shelterwood Treatment	Pre-Treatment Number of Pine Trees per Acre	Oak TPA ≥ 0.5 inches dbh	Hickory TPA ≥ 0.5 inches dbh	Oak and Hickory TPA ≥ 0.5 inches dbh
72	29	115	31.0	0	5	Light	0	5	0	5
72	33	116	4.5	100	50	Light	47	50	19	69
75	40	117	29.9	450	516	Intense	255	516	22	538
75	1	118	88.9	0	0	Light	92	0	0	0
75	2	119	49.9	500	50	Intense	130	50	0	50
75	2	120	5.1	500	50	Intense	130	50	0	50
72	22	121	15.0	0	240	Intense	0	40	0	40
72	22	122	15.4	0	240	Intense	0	40	0	40
72	20	123	2.6	0	0	Light	0	0	0	0
72	19	124	13.6	0	400	Intense	11	0	0	0
72	20	125	14.7	0	0	Light	0	0	0	0
72	19	126	1.5	0	400	Intense	11	0	0	0
72	19	127	1.8	0	400	Intense	11	0	0	0
71	18	128	18.9	1,100	0	Intense	58	0	18	18
71	34	129	25.1	50	52	Light	103	52	29	80
71	21	130	33.5	100	38	Light	29	38	0	38
71	35	131	26.5	300	0	Light	57	0	0	0
71	22	132	7.8	650	211	Intense	131	11	29	40
75	10	133	44.9	0	407	Intense	51	407	0	407

FSVeg Compartment	FSVeg Stand	Treatment Unit Number	Area (acres)	2011 TPA Oak w/ Height 2.0-4.5 ft (≥ 400)	2011 TPA Oak w/ Height ≥ 4.5 ft (≥ 100)	Intense or Light Shelterwood Treatment	Pre-Treatment Number of Pine Trees per Acre	Oak TPA ≥ 0.5 inches dbh	Hickory TPA ≥ 0.5 inches dbh	Oak and Hickory TPA ≥ 0.5 inches dbh
71	28	134	37.1	200	341	Intense	34	291	67	358
75	23	135	17.4	100	185	Intense	21	185	0	185
75	11	136	116.8	0	0	Light	19	0	0	0
75	31	137	26.3	200	0	Light	20	0	0	0
75	15	138	18.1	200	202	Intense	10	202	0	202
75	16	139	85.6	1,400	4	Intense	52	4	0	4
75	33	140	25.5	200	0	Light	24	0	13	13
75	32	141	44.0	200	0	Light	25	0	0	0
75	50	142	12.3	0	0	Light	44	0	0	0
75	37	143	40.4	200	6	Light	47	6	129	135
75	38	144	19.4	0	0	Light	26	0	0	0
75	5	145	25.8	1,200	106	Intense	35	106	0	106
75	39	146	24.3	1,200	16	Intense	30	16	13	29
75	19	147	90.0	600	0	Intense	368	0	0	0
75	49	148	9.6	350	150	Light	164	150	29	179
75	28	149	87.1	0	0	Light	67	0	0	0
75	18	150	36.4	400	13	Intense	18	13	0	13
76	21	151	19.5	0	0	Light	2	0	0	0
75	42	152	25.1	200	0	Light	36	0	0	0

FSVeg Compartment	FSVeg Stand	Treatment Unit Number	Area (acres)	2011 TPA Oak w/ Height 2.0-4.5 ft (≥ 400)	2011 TPA Oak w/ Height ≥ 4.5 ft (≥ 100)	Intense or Light Shelterwood Treatment	Pre-Treatment Number of Pine Trees per Acre	Oak TPA ≥ 0.5 inches dbh	Hickory TPA ≥ 0.5 inches dbh	Oak and Hickory TPA ≥ 0.5 inches dbh
75	17	153	29.9	200	0	Light	97	0	0	0
80	26	154	10.5	50	0	Light	71	0	0	0
80	12	155	72.7	400	0	Intense	30	0	0	0
80	33	156	39.2	0	0	Light	33	0	0	0
80	16	157	17.8	800	0	Intense	66	0	0	0
80	18	158	7.3	1,800	18	Intense	14	18	28	47
80	27	159	59.1	0	0	Light	146	0	0	0
80	21	160	42.2	3,400	403	Intense	49	403	59	462
83	2	161	5.3	200	0	Light	146	0	0	0
83	39	162	6.0	200	0	Light	239	0	0	0
83	3	163	49.8	0	0	Light	109	0	0	0
83	43	164	43.5	0	0	Light	136	0	0	0
83	20	165	39.8	0	0	Light	92	0	0	0
83	20	166	0.3	0	0	Light	79	0	0	0
83	21	167	28.3	0	0	Light	208	0	0	0
83	21	168	0.7	0	0	Light	168	0	0	0
83	21	169	0.1	0	0	Light	168	0	0	0
83	23	170	6.0	0	0	Light	88	0	0	0
83	23	171	1.9	0	0	Light	93	0	0	0

FSVeg Compartment	FSVeg Stand	Treatment Unit Number	Area (acres)	2011 TPA Oak w/ Height 2.0-4.5 ft (≥ 400)	2011 TPA Oak w/ Height ≥ 4.5 ft (≥ 100)	Intense or Light Shelterwood Treatment	Pre-Treatment Number of Pine Trees per Acre	Oak TPA ≥ 0.5 inches dbh	Hickory TPA ≥ 0.5 inches dbh	Oak and Hickory TPA ≥ 0.5 inches dbh
83	23	172	1.1	0	0	Light	93	0	0	0
83	23	173	1.8	0	0	Light	93	0	0	0
83	41	174	9.8	0	0	Light	55	0	0	0
83	26	175	19.3	2,000	0	Intense	100	0	0	0
83	26	176	1.7	2,000	0	Intense	80	0	0	0
83	27	177	12.1	0	0	Light	27	0	0	0
83	27	178	6.4	0	0	Light	28	0	0	0
83	16	179	98.4	800	0	Intense	154	0	0	0
83	16	180	2.3	800	0	Intense	154	0	0	0
83	16	181	0.8	800	0	Intense	154	0	0	0
83	16	182	0.2	800	0	Intense	154	0	0	0
83	19	183	8.2	0	0	Light	128	0	0	0
83	19	184	0.4	0	0	Light	127	0	0	0
83	31	185	16.4	200	0	Light	116	0	0	0
83	31	186	30.1	200	0	Light	116	0	0	0
83	31	187	4.4	200	0	Light	116	0	0	0
83	32	188	63.1	0	0	Light	50	0	31	31
83	6	189	53.9	0	7	Light	35	7	0	7
83	6	190	0.7	0	7	Light	35	7	0	7

FSVeg Compartment	FSVeg Stand	Treatment Unit Number	Area (acres)	2011 TPA Oak w/ Height 2.0-4.5 ft (≥ 400)	2011 TPA Oak w/ Height ≥ 4.5 ft (≥ 100)	Intense or Light Shelterwood Treatment	Pre-Treatment Number of Pine Trees per Acre	Oak TPA ≥ 0.5 inches dbh	Hickory TPA ≥ 0.5 inches dbh	Oak and Hickory TPA ≥ 0.5 inches dbh
83	35	191	15.8	0	0	Light	131	0	0	0
83	11	192	19.4	100	50	Light	189	0	0	0
83	10	193	51.7	0	0	Light	89	0	0	0
83	10	194	4.6	0	0	Light	81	0	0	0
83	10	195	3.3	0	0	Light	81	0	0	0
83	12	196	50.1	0	0	Light	40	0	0	0
83	14	197	10.8	0	0	Light	24	0	0	0
85	3	198	75.5	0	0	Light	378	0	0	0
85	42	199	5.7	2,400	0	Intense	24	0	5	5
85	6	200	25.5	1,200	36	Intense	270	36	0	36
85	6	201	11.6	1,200	36	Intense	0	36	0	36
85	41	202	7.5	800	0	Intense	52	0	0	0
84	12	203	17.8	0	0	Light	248	0	0	0
84	18	204	7.0	0	400	Intense	226	400	400	800
84	15	205	37.7	0	400	Intense	226	400	400	800
84	23	206	45.7	400	6	Intense	0	6	0	6
84	25	207	11.8	400	0	Intense	37	0	0	0
84	3	210	26.0	0	0	Light	323	0	0	0
84	7	211	27.6	0	0	Light	272	0	0	0

FSVeg Compartment	FSVeg Stand	Treatment Unit Number	Area (acres)	2011 TPA Oak w/ Height 2.0-4.5 ft (≥ 400)	2011 TPA Oak w/ Height ≥ 4.5 ft (≥ 100)	Intense or Light Shelterwood Treatment	Pre-Treatment Number of Pine Trees per Acre	Oak TPA ≥ 0.5 inches dbh	Hickory TPA ≥ 0.5 inches dbh	Oak and Hickory TPA ≥ 0.5 inches dbh
84	9	212	21.5	0	0	Light	113	0	0	0
85	27	213	60.8	1,200	0	Intense	111	0	0	0
85	48	214	8.0	0	7	Light	0	7	0	7
77	35	215	52.3	0	0	Light	98	0	0	0
77	3	216	128.8	0	0	Light	85	0	0	0
77	36	217	24.5	0	0	Light	48	0	100	100
77	18	218	6.0	0	0	Light	88	0	0	0
77	22	219	4.9	0	0	Light	172	0	0	0
80	1	220	5.4	0	0	Light	123	0	0	0
75	45	221	25.4	0	105	Intense	0	105	0	105
75	13	222	9.7	0	105	Intense	0	105	0	105
72	8	223	15.5	0	18	Light	41	18	0	18
72	39	224	7.6	0	0	Light	248	0	0	0
72	39	225	7.7	0	0	Light	248	0	0	0

Appendix C –Roadwork and associated travel management

Table 10. Roadwork proposed for the Dog Creek Project Area

Road ID	Road Name	County	Proposed Management Level	Existing - Reconstruction Mileage	New - Construction Mileage	Current Public Use ¹	Post Implementation Road Usage
Forest Service Roads							
485	---	Pope	ML3 to junction with 1417	1.5	---	Open	Open to the public up to junction with 1417 from the east.
485E	---	Pope	ML1	---	0.1	N/A	Closed to the public
	---					Closed to the public	
1791	---	Pope	No change ML 1	0.3	0.2	Closed to the public	Closed to the public
1417	Cemetery Rd Spur A	Pope	ML3. E-W through route	1.1	---	Seasonal restriction	Open to the public
487	---	Pope	ML1 after sale	0.5	---	Seasonal restriction	Closed to the public
493	Azotus Ch Rd	Pope	ML2 out of landing.	0.4	---	Seasonal restriction	Seasonal restriction
1422	---	Pope	ML2	0.4	0.1	Seasonal restriction	Seasonal restriction
1423	---	Massac	ML2 to perennial	0.6	---	Seasonal restriction	Seasonal restriction
1417B	Dog Creek Rd	Pope	ML2 to landing.	0.4	---	Closed to the public	Seasonal restriction
1406A	---	Pope	ML1	0.1	---	Closed to the public	Closed to the public
1406C	---	Pope	ML1	0.1	---	Closed to the public	Closed to the public
1406B	---	Pope	ML1	0.2	---	Closed to the public	Closed to the public
1425A	---	Massac	ML1	0.1	---	Closed to the public	Closed to the public
485B	---	Pope	ML1	0.1	0.1	Seasonal restriction	Closed to the public
485A	---	Pope	ML2	0.3	---	Closed to the public	Seasonal restriction
1425	---	Massac	ML2	0.4	---	Closed to the public	Seasonal restriction
1422A	---	Pope	ML1	0.3	---	Closed to the public	Closed to the public

Road ID	Road Name	County	Proposed Management Level	Existing - Reconstruction Mileage	New - Construction Mileage	Current Public Use ¹	Post Implementation Road Usage
485AA	---	Pope	ML1	0.3	---	Closed to the public	Closed to the public
144MCW	---	Massac	ML1	---	0.1		Closed to the public
1402	Lewis Cemetery	Pope	ML2 to stream ML1 after	0.4	---	Seasonal restriction	Seasonal restriction to stream crossing. Closed to the public beyond.
140B	---	Pope	ML1	---	0.1	N/A	Closed to the public
493A	---	Pope	ML1	---	0.1	N/A	Closed to the public
485D	---	Pope	ML1	---	0.2	N/A	Closed to the public
1400	---	Pope	ML1	---	0.1	N/A	Closed to the public
County Roads²							
1406	Roe Rd	Pope	County Road Extend as necessary ML3, ML1 beyond gate	1.2	---	Other public road	Open to the public to existing gate. Closed to the public beyond gate.
401	North Alcorn Rd	Pope	ML3	1.3	---	Other public road	Open to the public
	Dog Creek	Totals		10.0	1.1		

¹ – Current public use is based on the designations of the Shawnee National Forest 2014 Motor Vehicle Use Map.

² - The Forest Service would establish an agreement with the County for reconstruction of county roads proposed for use.

Table 11. Roadwork proposed for the Robnett Barrens Project Area

Road ID	Road Name	County	Proposed Management Level	Existing - Reconstruction Mileage	New - Construction Mileage	Current public use ¹	Post Implementation Current Public Use Road Usage
Forest Service Roads							
1449	Massac Ck Rd	Pope	ML3	1.1	---	Closed to the public	Open to the public
84B	---	Pope	ML1	---	0.1	N/A	Closed to the public
497B	---	Massac	Maintain current level of access ML2	0.1	---	Closed to the public	Seasonal restriction

Road ID	Road Name	County	Proposed Management Level	Existing - Reconstruction Mileage	New - Construction Mileage	Current public use ¹	Post Implementation Current Public Use Road Usage
497	Pine Mount	Massac	ML 2	1.2	---	Closed to the public	Seasonal restriction
1455	Robnett Rd	Pope	Maintain current public access as ML3	1.3	---	Closed to the public	Open to the public
1455E	---	Pope	ML2 to hunt camp ML1 beyond	0.5	---	Closed to the public	Seasonal restrict to junction of 1455EA (0.25 miles) and closed to the public beyond
1455D	Roblob Spur	Pope	ML1	0.2	---	Seasonally restricted	Closed to the public
1455C	Robnett Spur	Pope	ML2	0.9	---	Seasonally restricted	Seasonal restriction
1455EA	---	Pope	ML1	0.2	---	Closed to the public	Closed to the public
1455CA	---	Pope	ML1	0.1	---	Closed to the public	Closed to the public
114MC	---	Massac	Tank trap ML1	0.1	---	Closed to the public	Closed to the public
1714	---	Pope	ML2 to gate ML 1 thereafter	0.4	0.4	Closed to the public	Seasonal restriction for approximately 0.4 miles. Closed to the public beyond.
501	Bayou Rd	Pope	ML2	0.5	---	Closed to the public	Seasonal restriction
1473	---	Pope	ML1. Gate after use.	0.1	---	Closed to the public	Closed to the public
1449B	---	Massac	ML1 after deer camp	0.1	---	Closed to the public	Closed to the public
1449A	---	Pope	ML1	0.2	---	Closed to the public	Closed to the public
1455B	---	Pope	East portion ML1, ML3	0.3	0.2	Closed to the public	Open to the public for approximately 0.3 miles. Closed to public beyond
1456A	---	Pope	Gate after use could be changed to an extension of 497BA. ML1	0.1	---	Closed to the public	Closed to the public

Road ID	Road Name	County	Proposed Management Level	Existing - Reconstruction Mileage	New - Construction Mileage	Current public use ¹	Post Implementation Current Public Use Road Usage
497BA	---	Massac	ML2 to powerline, ML1 after. Connect to 1456A if undesirable to use 1456 to PC62	0.3	---	Closed to the public	Seasonal restriction
1456	Shadow Rd	Pope	ML3	0.7	---	Seasonally restricted	Open to the public
1456B	---	Pope	Gate new construction. ML1	0.4	0.2	Closed to the public	Closed to the public
1714A	---	Pope	ML2	---	0.4	Closed to the public	Closed to the public
1456C	---	Pope	ML 1	---	0.2	Closed to the public	Closed to the public
84AA	---	Pope	ML1	---	0.1	Closed to the public	Closed to the public
1456BA	---	Pope	Tank trap ML1	---	0.1	Closed to the public	Closed to the public
1455BA	---	Pope	ML1	---	0.1	Closed to the public	Closed to the public
1455A	SE Fence Rd	Pope	ML1	---	0.2	Closed to the public	Closed to the public
1782B	---		ML1	---	0.1	Closed to the public	Closed to the public
62PC	---	Pope	ML1	---	0.1	Closed to the public	Closed to the public
1450	---	Pope	ML3	0.2	1.2	Closed to the public	Open to the public
County Road²							
1782	West Lewis Rd	Pope	ML3	0.8	---	Other public road	Open to the public
84A	---	Pope	ML1	0.6	---	Other public road	Closed to the public
	Robnett	Barrens	Totals	10.4	3.4		

¹ – Current public use is based on the designations of the Shawnee National Forest 2014 Motor Vehicle Use Map.

² - The Forest Service would establish an agreement with the County for reconstruction of county roads proposed for use.

Table 12. Toadwork proposed for the Burke Branch Project Area

Road ID	Road Name	County	Proposed Management Level	Existing - Reconstruction Mileage	New - Construction Mileage	Current public use ¹	Post Implementation Current Public Use Road Usage
---		Pope	ML3	0.4	---	Closed to the public	Closed to the public
---		Pope	ML 1	0.1	---	Closed to the public	Closed to the public
---		Pope	ML 1	0.1	---	Closed to the public	Closed to the public
---		Pope	ML 1	0.1	---	Closed to the public	Closed to the public
---		Pope	ML 1	0.1	---	Closed to the public	Closed to the public
---		Pope	ML 1	0.1	---	Closed to the public	Closed to the public
---		Pope	ML 1	---	0.3	N/A	Closed to the public
	Burke Branch	Totals		0.9	0.3		

¹ – Current public use is based on the designations of the Shawnee National Forest 2014 Motor Vehicle Use Map.

The following public roads (non-forest system roads) are also proposed for use to access treatment areas under the action alternatives and to haul harvested trees under alternative 2 and 4. If maintenance is needed on these roads, it would be conducted in cooperation with the counties who maintain jurisdiction of the roads.

Table 13. Other public roads proposed for use

Road Name or ID	County	Jurisdiction
Gravel Pit Rd	Massac	County
IT 933MC	Massac	County
Massac Ridge Rd	Massac	County
Midway Rd	Massac	County
N Fk Barnes	Massac	County
N Massac Rd	Massac	County
Seven Mile Ck Rd	Massac	County
Azotus Rd	Pope	County
Bay City	Pope	County
Cooney Creek Rd	Pope	County
County Corner Rd	Pope	County
Cromeenes Hollow Rd	Pope	County
Hohman Lake Rd	Pope	County
IT 186PC	Pope	County
IT 933MC	Pope	County
Lewis Corner S Rd	Pope	County
N Massac Rd	Pope	County
Poco Rd	Pope	County
Rosebud Alt Rd	Pope	County
Rosebud Rd	Pope	County

Road Name or ID	County	Jurisdiction
Smithland Lock & Dam	Pope	Other Federal
Temple Hill Rd	Pope	County
Temple Ridge Rd	Pope	County
144MC	Massac	County

