Biological Evaluation

Land Application of Hydraulic Fracture Fluids, Berry Energy Inc.
Gas Well B-800

U.S.D.A. Forest Service, Monongahela National Forest
Cheat Ranger District
Tucker County, West Virginia

September 11, 2009

Approved By:

/s/ Theresa Arre Evans — *9/11/09*

Theresa Arre Evans, Cheat/Potomac Wildlife Biologist,
USFS Monongahela National Forest — Date

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Introduction
The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) requires Federal agencies to insure that any activities they authorize, fund, or carry out do not jeopardize the continued existence of any species, or adversely modify their critical habitat, that is federally listed, or proposed for listing as Threatened or Endangered. Federal agencies must comply with the ESA. Compliance includes a requirement to consult with the US Department of Interior Fish and Wildlife Service (USFWS) on projects that may affect federally listed threatened, endangered, or proposed species.

Pursuant to ESA, it is Forest Service (USFS) policy to review through the biological evaluation process, actions and programs authorized, funded, or carried out by the Forest Service to determine their potential for effect on threatened and endangered species and species proposed for listing (Forest Service Manual (FSM) 2670.31-32). This Biological Evaluation (BE) is the vehicle for evaluating and documenting the effects of the proposed Land Application of Hydraulic Fracture Fluids on federally threatened, endangered, or proposed species (FSM 2672.4) that occur or could potentially occur in the project area.

Project Area
The proposed fluid application area is a 3 acre area within the Fernow Experimental Forest (FEF) located within the Monongahela National Forest. The FEF is a 4615 acre experimental forest (39.03^{o}N, 79.67^{o}W) approximately 8 miles from Parsons, in Tucker County, West Virginia.

The proposed land application site lays along a ridge-top at elevations of approximately 2600'; covered with all mature saw timber-sized trees. Forest overstory vegetation in the area is generally oak (*Quercus spp*), black cherry (*Prunus spp.)* maple (*Acer spp.*) and poplar. Understory vegetation consists of striped maple, beech, viola species, greenbrier. The Fernow classifies this area as "uncommitted" , meaning there are no current research activities associated with this area.

Proposed Action
This Biological Evaluation covers potential effects to threatened, endangered or sensitive species or habitats caused by Berry Energy Inc.'s proposal for land application of approximately 21,000 gallons of hydraulic fracturing fluids across a 3 acre area on the Fernow Experimental Forest.

Background Information
Berry Energy, Inc. plans to conduct hydraulic fracturing of an additional potential gas horizon (called the Sycamore Grit) within the existing B-800 well which was drilled in 2008. Hydraulic fracture fluids that flow back from the well will be contained in tanks on the B-800 well site. After treatment of the fluids, Berry Energy proposes to discharge approximately 21,000 gallons of fluids by dispersing them onto the land as specified in the General Water Pollution Control Permit (GP-WV-1-88) for the direct disposal of treated wastewaters generated during oil and gas well work. In addition, the proposed land application area has been sized at 3 acres to accommodate the largest fluid volume and constituent concentrations anticipated in order to minimize risk for impacts to vegetation.

Berry Energy's West Virginia well work permit has been approved indicating compliance with State gas well permitting requirements. West Virginia Department of Environmental Protection, Office of Oil and Gas inspectors will enforce State oil and gas regulations during operations.

Berry Energy plans to complete hydraulic fracturing and land application before the onset of winter weather in 2009, beginning the work as early as September 2009. Land application is likely to occur in

October 2009.

Background Private Mineral Rights
The National Forest land on which the proposed activity is planned is underlain by mineral rights that were reserved by the seller when the United States acquired the land in 1915. This means that these mineral rights are privately owned, and the mineral owner has a reasonable right to explore for and develop their minerals. As owner of the underlying mineral rights, Berry Energy is legally entitled to make use of the surface to a degree and in a manner reasonably necessary for removal of natural gas under the terms and conditions of the mineral reservation.

Best Available Information
This Biological Evaluation (BE) documents the review of office records and field site visits by specialists. This BE was written utilizing the previous Biological Assessment written for the 2008 Berry Energy Inc. Gas Well development, Resource specialists Preliminary Project Proposal Response forms, results of botanical surveys and results of terrestrial wildlife surveys.

Summary Determinations for Threatened, Endangered, and Proposed Species
The following determinations of effects to T&E species have been made as a result of this BE:

SPECIES	DETERMINATION
Gray wolf (*Canis lupus*)	No Effect
Eastern cougar (*Felis concolor cougar*)	No Effect
Cheat Mountain salamander (*Plethodon nettingi*)	No Effect
Virginia northern flying squirrel (*Glaucomys sabrinus fuscus*)	No Effect
Shale barren rock cress (*Arabis serotina*)	No Effect
Virginia spiraea (*Spiraea virginiana*)	No Effect
Running buffalo clover (*Trifolium stoloniferum)*	No Effect
Small-whorled pogonia (*Isotria medeoloides*)	No Effect
Virginia big-eared bat (*Corynorhinus townsendii virginianus*)	No Effect
Indiana bat (*Myotis sodalis*)	No Effect

Threatened, Endangered, and Proposed Species within the Proposed Project Area
A current list of threatened, endangered and proposed (TEP) species that could occur in West Virginia and on the Monongahela National Forest was acquired from USFWS prior to this analysis. There are no species proposed for listing. All species on the USFWS list are addressed in this analysis.

ESA defines "critical habitat" as specific areas within a species' occupied geographic area, at the time it is listed, which are essential to its conservation and which may require special management considerations or protection. Critical habitat also covers specific areas outside the geographic area occupied at the time of listing, which the Secretary of Interior determines essential for conservation of the species. There is no critical habitat designated within the project area.

Not all of the federally listed species in West Virginia will occur within the proposed project area due to lack of suitable habitat or other factors. To determine which federally listed Threatened, Endangered, or species Proposed for listing could be affected by the proposed project, a "Likelihood of Occurrence" list was completed for each species and is included as part of the project record.

Threatened or Endangered Species

Shale-barren rockcress
The shale-barren rockcress *(Arabis serotina)* occurs on shale barrens in eastern WV (Strausbaugh and Core 1977). There is no suitable habitat on the FEF for this species (USDA 2004). Shale-barren rockcress was not identified as being present on the Fluid application area during surveys conducted August 2009 by USFS personnel.

Determination: No effect (NE)

Virginia spirea
Virginia spirea *(Spiraea virginiana)* grows along rocky, flood-scoured riverbanks. There are no waterways with these habitat conditions on the FEF, and this species does not occur on the FEF (USFS 2004). Virginia spirea was not identified as being present on the proposed pipeline route during surveys conducted August 2009 by USFS personnel.

Determination: No effect (NE)

Gray Wolf
The proposed project area is in the historic range of the gray wolf (*Canis lupus*) however the last confirmed occurrence of this species was 1900. The West Virginia Division of Natural Resources (WVDNR) considers the gray wolf extirpated from the state, and it will not be discussed in this BA.

Determination: No effect (NE)

Eastern Cougar
According to WVDNR records, the last confirmed occurrence of eastern cougar (*Felis concolor cougar*) was 1887. The WVDNR and USFWS consider this species extirpated from WV, therefore, it is not covered in this BE. Although there are a few reports of cougar in WV, these sightings are believed to be misidentified, escaped or released captive animals.

Determination: No effect (NE)

Cheat Mountain salamander
The Cheat Mountain salamander *(Plethodon nettingi)* is a relict species with isolated populations (Pauley and Pauley 1997). It is geographically restricted to high-elevation forests containing a red spruce component and mixed deciduous forests with a Bazzania-dominated forest floor. The species' entire range is limited to the higher portions of the Allegheny Mountains in northeastern West Virginia (Pauley and Pauley 1997). Distributions of Cheat Mountain salamander populations occur in Tucker, Randolph, Pocahontas, Grant, and Pendleton counties (Pauley and Pauley 1997), extending from Backbone Mountain in the north to Back Allegheny Mountain in the south. This species commonly occurs from elevations of 2900 ft. to 4799 ft. (Petranka 1998), with most colonies occurring at elevations greater than 3500 ft. (Pauley 1991).

Currently, a small portion of the FEF could contain habitat for the Cheat Mountain salamander although this area lies to the southeast of the fluid application area and would not be impacted by the action. No Cheat Mountain salamanders have been captured on the FEF. Spring ground searches in the spring of 2001, 2002, 2003, and 2004 for the Cheat Mountain salamander failed to document any individuals of this species on the FEF (USFS 2004). Field review of the application area conducted September 11, 2008 suggests that the proposed action will not impact potential habitat for Cheat Mountain salamander.

Determination: No effect (NE)

Virginia northern flying squirrel
Virginia northern flying squirrels *(Glaucomys sabrinus fuscus)* occur in forested areas throughout the northern U.S. and Canada. The southern and central Appalachian Mountains, the Black Hills, the southern

Rocky Mountains, and the Sierra Nevada contain disjunct populations (Wells-Gosling and Heaney 1984). In WV, the range of the Virginia northern flying squirrel extends southward from the Mount Storm Reservoir (Tucker county), to Briery Knob (Pocahontas county) and Rabbit Run (Greenbrier county).

In the central Appalachians, VNFS commonly prefer conifer/hardwood ecotones or mosaics dominated by red spruce and fir with hemlock (*Tsuga canadensis*), beech (*Fagus grandifolia*), yellow birch (*Betula allegheniensis*), sugar or red maple (*Acer rubrum*) and black cherry (*Prunus serotina*) associates. VNFS have also been captured in northern hardwoods with conifer understory (Stihler et.al. 1995). Northern flying squirrels have been captured in stands of various ages, understories, densities, and species composition, but most have been in moist forests with some widely-spaced, mature trees, abundant standing and downed snags (USDI 2001), usually with some conifer (spruce, hemlock, fir) present. These habitats seem well suited to WVNFS' gliding locomotion, cavity nest requirements, and reliance on wood-borne fungi and lichens for food (USDI 1990).

The northern flying squirrel predictive model developed by the Northern Research Station was utilized to determine the FEF suitability for this species (Menzel et al. 2006). Using the Menzel model, an area to the south/southeast and another area to the northeast have a "50-75%" probability of being occupied by northern flying squirrels.

Live trapping sessions in the summers of 2001, 2002, 2003, and 2004 did not captured any northern flying squirrels on the FEF. The nearest capture record for this species is outside the FEF, approximately two and one-half miles to the south of the proposed project on McGowan Mountain (USDA 2004).

Determination: No effect (NE)

Small whorled pogonia

Small whorled pogonia (*Isotria medeoloides*) was listed as endangered on October 12, 1982. A recovery plan was completed in 1985 and revised in 1992. On October 6, 1994, the species was downgraded to threatened status.

Small whorled pogonia populations are widely scattered from Maine to Georgia, and west to Tennessee and Ohio. This species occurs in mixed deciduous or mixed deciduous/coniferous forests ranging in age from 30 to 80 years. The majority of small whorled pogonia sites share several common characteristics, including sparse to moderate ground cover in the microhabitat of the orchids (except when among ferns), a relatively open understory canopy, and a proximity to logging roads, streams, or other features that create long, persisting breaks in the forest canopy (Mehrhoff 1989). Shade may be an important habitat component. Typical overstory species associated with this orchid include white pine (*Pinus strobus*), Virginia pine (*Pinus virginiana*), red oak (*Quercus rubra*), white oak (*Q. alba*), black oak (*Q. velutina*), red maple, eastern hemlock, American beech, and tulip poplar (*Liriodendron tulipifera*). A few ground-layer species are associated with both the northern and southern parts of the species' range. These include partridge berry (*Mitchella repens*), Indian cucumber root (*Medeola virginiana*), sweet low-bush blueberry (*Vaccinium angustifolium*), spicebush (*Lindera benzion*), false ginseng (*Aralia nuducaulis*), and white snakeroot *(Eupatorium rugosum*).

Small whorled pogonia has staggered emergence, depending upon the individual orchid's reproductive status. In West Virginia lower and warmer elevations (<2600 ft.), small whorled pogonia generally emerges in May and flowering occurs from June to early July.

The potential for affecting small whorled pogonia is very low because of its low likelihood of occurrence. No individuals of this species were detected during the site-specific botanical survey of the fluid application site in August 2009. The closest known occurrence is in Greenbrier County. The forest and

soil types associated with this occurrence do not occur on the FEF. Therefore, the *Biological Assessment for the Fernow Experimental Forest* considered the small whorled pogonia absent on the FEF. However, based on the low likelihood of occurrence, and the small size of proposed impact area, the probability of the project affecting this species is so low as to be discountable.

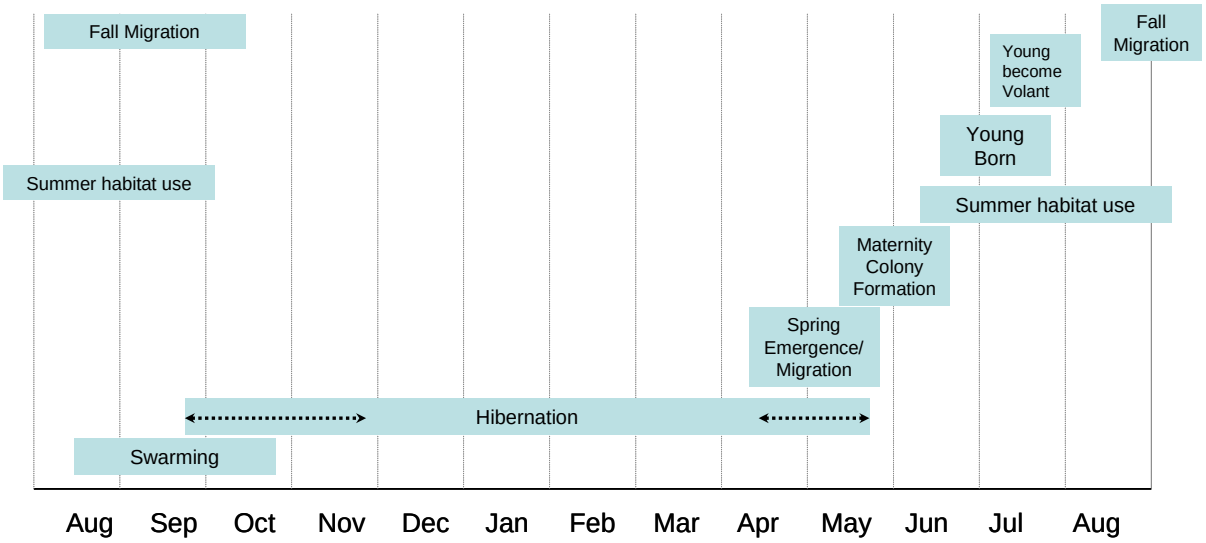
Determination: No effect (NE)

Indiana bat:

Detailed life history requirements, general biology, distribution, habitat information, causes for decline, environmental baseline, and specific guidance for the Indiana bat may be found in the *Monongahela National Forest Land and Resource Management Plan* (FP) (USDA 2006)**,** Appendix X: *Biological Assessment for Threatened and Endangered Species* (USDA 2006) p. 35, and the *Programmatic Biological Opinion (BO) for the Monongahela National Forest 2006 Forest Plan Revision* (USDI 2006) p. 27. The *Biological Assessment for the Fernow Experimental Forest* (USFS 2004) and corresponding *Biological Opinion (BO) for the five year plan of research activities scheduled on the U.S. Department of Agriculture's Fernow Experimental Forest (FEF)* (USDI 2005) have also been used in this fashion.

The U.S. Fish and Wildlife Service listed the Indiana bat (*Myotis sodalis*) as endangered on March 11, 1967. The USFWS Recovery Plan was signed October 14, 1983 (USDI 1983). A "Draft Indiana Bat Recovery Plan, First Revision; Draft Survey Protocol" (USDI 1997) was released for public review and comment on April 16, 2007.

The Indiana bat is a migratory species ranging throughout the eastern U.S., from Oklahoma, Iowa, and Wisconsin, east to Vermont and south to northwestern Florida (Hall 1962, Romme et al. 1995). The Indiana bat's annual life cycle consists of hibernation, spring migration, birthing (parturition), raising of young by females (lactation), fall migration, mating (swarming), and hibernation. The following discussion provides a general overview of the life cycle of the Indiana bat. An outline of the Indiana bats annual life cycle is provided below. The MNF provides habitat for swarming, hibernating, and summering Indiana bats.



Indiana bat annual life cycle.

Swarming

Indiana bats begin arriving at hibernacula or surrounding area from mid-August to October (Kiser and Elliot 1996) and November (Hall 1962, Humphrey 1978). Indiana bats will periodically use tree roosts

during the fall swarm (Menzel et al. 2001). The inactive hibernation period for Indiana bats is approximately 190 days (October-April for females, November-May for males), depending upon conditions in the hibernacula (Hall 1962).

Hibernation

Indiana bats tend to hibernate in the same cave or mine at which they swarm (LaVal et al., 1976; C. Stihler, pers. observation, October, 1996), although swarming has been observed at hibernacula other than those in which the bats hibernated (Cope and Humphrey, 1977). It is generally accepted that Indiana bats, especially females, are philopatric, that is, they return annually to the same hibernaculum (LaVal and LaVal, 1980). Most bats of both sexes enter hibernation by the end of November (mid-October in northern areas).

Summer/maternity roosting habitat

Indiana bats emerge from the hibernacula from mid-April through May (Hobson and Holland 1995). Females generally leave the cave earlier than males (Humphrey 1978, LaVal and LaVal 1980).

Indiana bat roosts are placed into one of two categories: primary or alternate (Callahan et al. 1997). Primary roost trees are trees that are used by >30 bats on more than one occasion. Fewer individuals use alternate roosts. Both roost types are essential for meeting Indiana bat maternity and summer roost requirements.

Some Indiana bat maternity colonies may use more than a dozen roosts (USDI 1996, Foster and Kurta 1999), and maternity colonies may contain up to 100 individuals, including young (Brack 1983, Jordon 1986). Male Indiana bats stay near the winter hibernacula during the summer, and occasionally may roost in the hibernacula or other caves during the summer (Myers 1964, Jordon 1986). However, it is much more common for male Indiana bats to roost in trees with sloughing bark and cavities (Hobson and Holland 1995, Stihler 1996). Indiana bat males may switch roost trees from day to day, and often roost in dead trees on upper slopes and ridge tops within 1.5 miles of the hibernaculum (Kiser and Elliott 1996).

Tree species does not appear to be an important factor in roost site selection. Tree structure, specifically the availability of exfoliating bark with roost space underneath, is a critical characteristic for roost trees. Indiana bat use of snags appears to be influenced by bark characteristics. The ability of a tree species to produce exfoliating bark probably influences Indiana bat use of that tree (Ford et al. 2002, Britzke et al. 2003, Callahan et al. 1997).

Foraging habitat

From May to October, Indiana bats forage nightly for terrestrial moths and aquatic insects, primarily in upland forests and riparian woodlands. On the MNF, foraging, roosting, and swarming are believed to be concentrated within 5 miles of hibernacula, although individual bats can occur outside this area (USDA 2001). The area within 5 miles of hibernacula, excluding hibernacula and key areas, is considered primary range and is intended to be managed to provide the basic habitat components needed by the Indiana bat over time.

Causes of past and current declines

Disturbance to hibernacula is one of the major factors leading to the decline of this species. In addition to population threats from human disturbance, hibernating Indiana bats are also vulnerable to natural disturbances, and destruction of any hibernaculum can have a tremendous impact on the population because of the limited number of hibernacula (Hall 1962). Mid-winter cave flooding can cause significant mortality by drowning trapped bats or by inducing arousal (Cope and Ward 1965).

Exposure to and accumulation of environmental contaminants may potentially occur during the fall swarming period when bats are intensively foraging and gaining weight prior to entering hibernation (Reidinger 1972), a factor that has been directly implicated in local extirpations of bat populations and suspected to be a factor in the decline of insectivorous bat species in North America (Clark 1981).

Within the Northeast Recover Unit of Indiana bat populations (USDI 2008), specifically within New York, Vermont, Connecticut and Massachusetts, biologists and/or cavers have documented a mysterious illness that is causing widespread mortality of the wintering bat populations in the affected hibernacula. This illness has been dubbed "white-nose syndrome" (WNS) due to the white fungus found on the noses of many of the affected bats. At this time, researchers do not know what is causing the illness or how it is spread. Species affected include little brown bat (*Myotis lucifugus*), Indiana bat (*Myotis sodalis*), eastern small-footed bat (*Myotis leibi*), northern long-eared bat (*Myotis septentrionalis*), and eastern pipestrelle bat (*Pipistrellus subflavus*) ("Bats and White-nose Syndrome" 2008; USDI 2008).

West Virginia populations of the Indiana bat fall within the Appalachian Recovery Unit. Symptoms associated with white-nose syndrome have been observed in several West Virginia caves in 2009. Precautionary measures to overt the spread of WNS, including but not limited to cave closures, have been implemented in West Virginia and on the Monongahela National Forest.

Habitat in the 3 acre Proposed Project Area

Hibernacula

The proposed project area does not provide suitable habitat for Indiana bat winter hibernacula, however, the site is located in relatively close proximity to known hibernacula. Specifically, entrances to Big Springs Cave are located approximately 0.4 miles from the site, Two Lick Run is located ~ 3.3 miles south, and Coal Run cave is ~ 3.1 miles east. Winter surveys have been conducted periodically in Big Springs Cave since 1952. The most recent winder survey, completed in December 8, 2008 conducted by the WV Department of Natural Resources resulted in a count of 474 M. sodalis in Big Springs Cave (Craig Stihler, pers. comm. 2009). Historically, only a few Indiana bats have been documented during winter counts of Two Lick Run (3-7 Indiana bats) and Coal Run Caves (1 Indiana bat). Traditionally, Two Lick and Coal Run caves have not been considered to be significant hibernacula and are not surveyed regularly by WVDNR. Therefore, trend information is not available for these two caves. Two Lick Run Cave was last surveyed January 27, 2004 and one Indiana bat was documented. None were observed during the previous survey. Coal Run Cave has not been surveyed in recent years. FS records indicate that in 1993 one Indiana bat was found.

Key areas

The proposed project area is located approximately 0.52 miles from a stand identified as part of the "key area" associated with Big Springs Cave. Key areas are meant to provide mature forest habitat near hibernacula for swarming and roosting habitat.

Primary Range

Because the proposed application site is within 5 miles of hibernacula, the area is considered part of the primary range, wherein Indiana bats are presumed present from April 1-November 15. As primary range, the application area provides habitat for summer roosting, foraging, and fall swarming. In a study of *M. sodalis* conducted in the vicinity of Big Springs Cave from June-November of 1995, Stihler (1996) captured 69 individuals of the species, with males captured at the hibernaculum beginning in June, and females starting in mid-August. He found that *M. sodalis* males foraged and day roosted near the

hibernaculum throughout the summer, often switching roost trees from day to day. Anabat survey data from the Northern Research Station (Ford et al. 2005) also indicate that Indiana bats regularly use the Fernow Experimental Forest for foraging during the summer months.

Maternity sites
The Indiana bat maternity roost site discovered in 2004 is located approximately six miles southeast of the proposed well site. No other Indiana bat maternity roosts have been identified on the Forest to date;

Potential Effects of the Hydraulic Fracture Fluid Application
Hibernacula
Direct effects: The land application of hydraulic fracture fluids will not directly affect Big Springs cave.

Indirect effects: Soils found on the application site are predominantly silt loams derived from sandstone and shale from Hampshire formations. These formations do not form caverns or karst features and are very unlikely to have any hydro-geological connectivity to Big Springs Cave beyond normal porosity and small fractures and fissures.

The application area is also approximately 3,000 feet or more from the closest cave entrance and avoids all known underground cave passages by even greater distances. Field reviews conducted in September 2009 failed to identify any additional sinkholes within the application area. No major hydrological or geological connection between the application site and Big Springs Cave is known to exist. No karst features are evident, thus potential effects to the Big Springs cave environment are extremely unlikely.

Therefore, surface application is unlikely to have any indirect impact on bats or their habitats within the cave given the lack of karst features found in the application area.

Maternity Habitat
No maternity sites are known to exist within the application area, on the FEF, or MNF lands adjacent to the project area. Over the years, mistnet and other surveys have been completed in application area vicinity. No evidence of maternity activity has been documented in or near the project area as a result of these surveys. Hydraulic fluid application for this project will occur in September and/or October, well outside maternity use time periods. Therefore, there will be no effect to maternity sites during this activity.

Summer Roosting, Foraging and Swarming Habitat
Direct effects: Tree species in the application area consist of oak, maple, black cherry, ash and hickory. Indiana bats that remain in the area of hibernacula are known to utilize these tree species as summer roosts. However, there are no known Indiana bat male roost sites within the 3 acre application area. The application and project area does fall within Indiana bat swarming period (August 16 through November 14), foraging (5 mile radius) and summer roosting. As a result, there is a chance that bats may still be foraging when the actual fluid application occurs. Because bats are nocturnal and the fluid will be applied during daylight hours, there will be no chance for hydraulic fluids to be sprayed on flying bats. There is a possibility that a bat could be sprayed by fluids if the person applying the liquid sprays directly in a tree cavity or directly on loose bark exposing a bat if it is roosting there. This very slight risk will be mitigated by the requirement that land application spray must avoid direct contact with loose tree bark and tree cavities.

Indirect effects: The application area falls within Indiana bat primary range. Consequently, Indiana bats are assumed present during the summer and fall. A 5 mile radius around Big Springs is composed of approximately 50,265 acres. The proposed application will occur on a maximum of 3 acres with no tree

harvest activities associated with this project. There is a possibility that if fluid applications are not distributed evenly across the 3 acre area, solution concentrations may be at levels to alter land conditions and may unintentionally kill some trees over time. These trees may then provide additional roost snags in this area. However, this is a small discountable affect, therefore, fluid application will have no indirect affects to Indiana bat primary range, foraging or roosting habitat.

Cumulative Effects
Given the extremely small scale of direct and indirect effects to any Threatened, endangered or proposed species, the contribution of this project to cumulative effects is negligible and would be immeasurable.

Effects due to "white nose syndrome" are not expected to have bearing on the proposed project.
Determination: No effect (NE)

Virginia big-eared bat:
The Virginia big-eared bat was listed as endangered under provisions of the Endangered Species Act on December 31, 1979. The USFWS developed the Virginia big-eared bat Recovery Plan, and the plan was signed on May 8, 1984.

Distribution and Habitat
The Virginia big-eared bat is a geographically isolated, sporadically distributed cave obligate subspecies of Townsend's big-eared bat (*C. t. townsendii*). It occurs in karst areas in eastern Kentucky, eastern West Virginia, extreme western Virginia, and North Carolina (Clark and Lee 1987).

Hibernacula
Virginia big-eared bats return to hibernacula in September, and continue feeding during warm evenings. Throughout their range, Virginia big-eared bats hibernate in caves and mines, which provide cold to near freezing temperatures (36.5^{o} to 49.1^{o} F). In Kentucky and West Virginia, Virginia big-eared bats occasionally hibernate in clusters of several hundred to more then a thousand, occupying the same spot within the cave year after year.

Summer/maternity roosting habitat
Virginia big-eared bats generally reach maternity roost sites by early May (Lacki et al. 1994). Females return to the same maternity roost site year after year (Clark 1991).

Female Virginia big-eared bats form maternity roosts in limestone caves and sandstone rock shelters (Adams et al. 1994, Lacki et al. 1994), and may use rock shelters as summer feeding roosts (Lacki et al. 1993). Male Virginia big-eared bats form bachelor colonies that also are dependent on caves and rock shelters in the summer, although they inhabit different areas of the roost site then females. Nursery colonies disperse in August, following weaning. Virginia big-eared bats move readily from one roost to another, but they probably do not migrate long distances between summer roosting and winter hibernacula habitat (Barbour and Davis 1969).

Food Habits
Conditions outside the cave must be suitably dark for Virginia big-eared bats to begin foraging (Barbour and Davis 1969). The high maneuverability of this bat species allows it to forage both in cluttered and open habitats (Dalton et al. 1986, Adams et al. 1994, Burford and Lacki 1995, Wethington et al. 1996). Virginia big-eared bats tend to concentrate foraging activity near night roosts. Use of different foraging habitats among Virginia big-eared bats populations or subspecies may be a response to different habitat availabilities and demonstrates its flexibility to local conditions (Adams et al. 1994).

In general, foraging area size does not differ between males and females, though foraging area may increase during the summer for females. Forage areas for females are the smallest in May, due to recurrent visitations to maternity roosts to nurse their young.

A WVDNR study found that in WV, bats foraged in wooded areas and open habitats (Stihler 1995). Grazed areas used by the bats consisted of old fields with considerable vegetative structure composed largely of thistles, scattered trees, and riparian vegetation along a small creek. The greatest distance traveled was approximately 6 miles from the cave.

Reproduction

Females mate in their first autumn; however, males do not reach sexual maturity until their second year. Mating usually occurs during the first 3 weeks of October, but fertilization is delayed until spring when ovulation takes place. In WV, female bats give birth to a single offspring in June. If disturbed, female Virginia big-eared bats can carry their young to other parts of the cave, or to other caves. At 1 month, they have developed adult-length forearms, and by 6 weeks, young are weaned (Whitaker and Hamilton 1998, Wilson and Ruff 1999).

Causes of Past/ Current Declines

The greatest threats to Virginia big-eared bat populations are human disturbance and vandalism at maternity and hibernating sites. During hibernation, bats depend on stored body fat. When disturbed during winter, they emerge from hibernation and move to a safer roosting area in the cave, requiring the bat to raise its body temperature by burning stored fat. As few as two disturbances can cause a cave dwelling bat to expend all its winter fat reserves, leading to starvation (Harvey et al. 1999). If maternity colonies are disturbed, females may abandon their flightless newborns, move their pups to locations less suitable for newborn survival (Harvey et al. 1999), or drop their pups in transit if sufficiently panicked. Bats have very low reproductive rates – a female bat will give birth to a single young every 1 or 2 years. Therefore, even seemingly small reductions in bat populations could devastate populations (Harvey et al. 1999).

Vandalism has resulted in destruction of many bat colonies simply because bats often are viewed as nuisances or threats to human health (USDI 1996). Cave gating appears to be the most effective way to protect Virginia big-eared bat populations at high risk of disturbance

Other possible causes of bat population declines include natural disasters (flooding, cave subsidence), loss of roosting sites due to sealing mine entrances, cave commercialism, chemical contamination, and loss of foraging habitat. Stream impoundment can create permanent or seasonal cave flooding, and cave commercialization may disturb roosting and hibernating bat colonies (USDI 1983). Timber harvesting, water quality degradation, stream channelization, and other actions potentially could alter foraging habitat in some cases (Grindal 1996).

Insecticides, particularly those used for gypsy moth (*Lymantria dispar*) control, may adversely affect the food supply (Sample and Whitmore 1993). Bats have many potential predators, including house cats, owls, hawks, raccoons (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and snakes.

Habitat On or Near the Proposed Project Area

West Virginia supports the species largest populations, particularly, Pendleton County (Barbour and Davis 1969; Stihler pers. comm. 2000). West Virginia's Cave Mountain Cave, Hellhole, Hoffman School Cave, Sinnit Cave, and Cave Hollow-Arbogast Cave are designated as "Critical Habitat" for this species. Important habitat for the Virginia big-eared bat on the MNF consists of identified summer colony sites, hibernation sites, and foraging areas (6 mile

radius from hibernacula and summer colonies**).**

The closest cave to the project area known to harbor the Virginia big-eared bat is Big Springs Cave with two entrances located within approximately 0.5 miles (east-northeast) of the application site. A single male Virginia big-eared bat *(Corynorhinus townsendii virginianus)* was captured during late summer mist net surveys on the FEF in 1995. A December 2008 winter survey of Big Springs Cave documented one Virginia big-eared bat using Big Springs Cave as a winter hibernacula. Big Springs is not known to harbor a VBEB maternity or summer colony.

The next closest cave inhabited by Virginia big-eared bats is Cave Hollow-Arbogast, located approximately 5.5 miles east of the proposed site, in which 698 Virginia big-eared bats were counted during the summer colony census in 2006 (WVDNR 2006).

Mist net surveys on the FEF captured a single Virginia big-eared bat during the late summer 1995 and again on May 30, 2008.

Virginia big-eared bats forage and night roost in a wide variety of habitats, riparian areas, upland forests, and fields all of which are can be found around the project area. Both male and female Virginia big-eared bats are known to roost close to the hibernacula during the spring and summer. Therefore, the 3 acres identified for fluid application may provide suitable foraging and night roosting habitat for Virginia big-eared bats. Although surveys document the presence of Virginia big-eared bats on the FEF, the low capture rate suggests that the project area has minimal Virginia big-eared bats roosting, foraging and hibernacula use.

Potential Effects of the Hydraulic Fracture Fluid Application

Hibernacula, Maternity and Summer Roosting habitat

Direct effects: The land application of hydraulic fracture fluids will not directly affect Big Springs cave, rock shelters, or cliff faces that may be used for hibernacula or roost sites. Therefore, no direct effects to summer roosting or hibernating Virginia big-eared bats or habitats are anticipated.

Big Springs Cave is not considered to be a maternity site for this species. Therefore, no direct or indirect effects to maternity colonies or habitat are expected. Cave Hollow – Arbogast is the nearest know maternity site and is too far removed from the project for these activities to contribute any impacts.

Indirect effects: Soils found on the application site are predominantly silt loams derived from sandstone and shale from Hampshire formations. These formations do not form caverns or karst features and are very unlikely to have any hydro-geological connectivity to Big Springs Cave beyond normal porosity and small fractures and fissures.

The application area is also approximately 3,000 feet or more from the closest cave entrance and avoids all known underground cave passages by even greater distances. Field reviews conducted in September 2009 failed to identify any additional sinkholes within the application area. No major hydrological or geological connection between the application site and Big Springs Cave is known to exist. No karst features are evident, thus potential effects to the Big Springs cave environment are extremely unlikely.

Therefore, surface application is unlikely to have any indirect impact on VBEBs or their habitats within the cave given the lack of karst features found in the application area.

Summer Roosting, Foraging and Swarming Habitat

Direct effects: Tree species in the application area consist of oak, maple, black cherry, ash and hickory.

Virginia big-eared bats night forage and do "roost" periodically during feed, however usually return to the cave/rock shelter before daylight. The fluid application and project area does fall within VBEB swarming period (August 16 through November 14), and foraging area (6 mile radius). As a result, there is a chance that bats may still be foraging when the actual fluid application occurs. Because bats are nocturnal and usually return to the cave/rock shelter before daylight, fluid applications applied during daylight hours will have no effect to foraging bats. There is a discountable risk that a bat may still be roosting during the daytime, however the requirement that land application spray must avoid direct contact with loose tree bark and tree cavities will prevent any effects.

Indirect effects: The application area falls within Virginia big-eared bat foraging range. Consequently, VBE bats are assumed present during the summer and fall. A 6 mile radius around Big Springs is composed of approximately 72,382 acres. The proposed application will occur on a maximum of 3 acres with no tree harvest activities associated with this project. There is a possibility that if fluid applications are not distributed evenly across the 3 acre area, solution concentrations may be at levels to alter land conditions and may unintentionally kill some trees over time. These trees may then provide additional roost snags in this area. However, this is a small discountable affect, therefore, fluid application will have no indirect affects to Indiana bat primary range, foraging or roosting habitat.

Cumulative Effects
Given the extremely small scale of direct and indirect effects to any Threatened, endangered or proposed species, the contribution of this project to cumulative effects is negligible and would be immeasurable.

Effects due to "white nose syndrome" are not expected to have bearing on the proposed project.
Determination: No effect (NE)

Running buffalo clover
The USFWS listed the Running buffalo clover as endangered on July 6, 1987, and an updated recovery plan was published in June 2007 (USDI 2007).

Distribution and habitat
Running buffalo clover formerly grew over a broad area from the western Allegheny Mountains across the Upper Ohio Valley westward to Missouri and Kansas (Cusick 1989). Once widespread the species range is now restricted to West Virginia, Kentucky, Indiana, Ohio, and Missouri. Populations of running buffalo clover range from just a few to tens of thousands of individuals (USFS 2007).

Many botanists believe running buffalo clover is an open woodland-savanna species dependent on disturbance for survival. Potential habitat for running buffalo clover typically exists in lightly disturbed forests and woodlands on soils derived from circumneutral geologic features (NatureServe 2006).

Reproduction
Running buffalo clover is a stoloniferous perennial, which spreads by seed and stolon. In West Virginia, flowers are produced from late May through June and most seeds are set in July and August. Seed scarification greatly enhances germination, but germination also may be stimulated by spring temperature fluctuations (USDI 2007). Historically, large herbivores scarified seeds digestively, and these seeds may have had enhanced germination rates (Ford et al. 2003). On the FEF, this species is most often found on logging trails that are disturbed approximately once every 10 years during timber removal. These types of areas are heavily utilized by white-tailed deer in the Appalachians (Wentworth et al. 1990), which supported the hypothesis that white-tailed deer might be capable vectors of running buffalo clover seed (Cusick 1989). However, Ford et al. (2003) found that although white-tailed deer are potential viable

vectors for running buffalo clover seed, germination and survival of clover seed is low. Morris et al. (2002) state that as viable seeds were excreted in the manure of ungulates, there was a high enough nitrogen level to support running buffalo clover to complete its life cycle before another ruminant came along and consumed new seed.

Causes of Past/Current Declines
Past running buffalo clover declines have been attributed to habitat loss from forest canopy closure, buffalo herd extirpation, habitat clearing, disease from other clovers, pollinator loss, and fire regime changes. Other limiting factors may include: poor dispersal characteristics, possible loss of rhizobial associates (Morris et al. 2002), increased herbivory from white-tailed deer and eastern cottontail rabbits (*Sylvilagus floridana*) (Ford et al. 2003), competition from exotic plants (Campbell et al. 1988) and restricted gene flow (Hickey and Vincent 1991, Crawford 1995).

Habitat on the Fernow Experimental Forest
Initial discovery of running buffalo clover on the FEF occurred in June 1993. This species was found on several compartments, mainly along existing skid roads underlain by limestone derived soils.

Running buffalo clover has a high affinity for calcium-rich soil, which is abundant in the eastern portion of the FEF where the Greenbrier Limestone formation is exposed. Although it may be found elsewhere it is most often found in locations underlain by limestone or other calcareous bedrock. This species persists in mesic woodlands with partial sunlight and periodic disturbance.

Habitat On or Near the Proposed Project Area
Running buffalo clover (*Trifolium stoloniferum*), is known to occur within 200 feet of the boundary of the proposed application area. However, no running buffalo clover was found within the proposed application area, despite very meticulous survey coverage of the area.

Determination: No effect (NE)

REGIONAL FORESTER'S SENSITIVE SPECIES

The NFMA implementing regulations under which the Forest Plan was prepared require National Forests to maintain viable populations of species that occur on a National Forest (36 CFR 219.19, USDA Department Regulation 9500-4). As part of the strategy to address NFMA viability requirements and avert the need for listing under the Endangered Species Act (ESA), each region of the Forest Service has developed a list of RFSS, which are species for which population viability may be a concern. Direction in the Region 9 supplement to the Forest Service manual emphasizes maintaining viability for RFSS and ensuring that management activities do not result in trends toward federal listing (FSM 2670.22, 2670.32). Manual direction requires Forests to determine whether their actions affect RFSS, and if so, whether those actions will result in a loss of viability or a trend toward federal listing (FSM 2670.32).

This analysis addresses all RFSS on the MNF. To focus this analysis on those RFSS with the potential to be affected by the project, a Likelihood of Occurrence table was prepared to summarize the habitat requirements and known occurrences of RFSS and determine the likelihood that the species or potential habitat could occur in the area to be affected by the project. The Likelihood of Occurrence table is included in the project record; only those RFSS with the potential to occur in the application area are discussed here.

RFSS that could occur in the Areas to be affected by application of hydraulic fracture fluids.

Species	Potential for Occurrence
Red-headed woodpecker	Low likelihood, but cannot be ruled out
Timber rattlesnake	Due to very general habitat description, potential occurrence cannot be ruled out
A Noctuid moth	Due to very general habitat description, potential occurrence cannot be ruled out
Diana Fritillary	Due to very general habitat description, potential occurrence cannot be ruled out
Blunt-loped grapefern	May be present; the identification cannot be confirmed until autumn when this species turns a distinctive color

Based on the wooded habitat present within the application area, it is possible that the species listed above could be found or use this area during their life cycle.

Red-headed woodpecker
Occupies a wide range of habitats, but most are characterized by open areas for feeding, multiple snags for nesting, roosting and foraging, and a secure food supply. Some of the habitats used are: open deciduous and riparian woodlands, orchards, parks, agricultural lands, savanna-like grasslands, beaver ponds with snags, forest edges, burned forests, and flooded bottomland forests. Habitats are similar in both breeding and wintering range, but winter distribution most determined by presence of food.

Begin nest-building as early as February and egg-laying as early as mid-April. An average of 4-7 eggs are laid in the cavity and incubated by both parents for 12-14 days. May have two broods per season and will lay a second clutch if first fails. A pair may use the same cavity for several years in a row. Red-headeds may use cavities excavated by other woodpeckers or even force some species to abandon active cavities.

This bird consumes seeds, nuts, sap, corn, fruit, insects, bird eggs, nestlings, adult birds, and mice. It eats mostly insects and plant material in summer and mostly nuts (acorns and beechnuts) in winter. Will forage on ground, capture insects in flight, glean food from vegetation, or chisel trees for wood-boring insects and sap. Most adapted of all the woodpeckers for flycatching. Will store food for winter (grasshoppers, nuts, corn, and fruit) in natural crevices of trees and posts, in tree cavities, under bark, and under railroad ties and shingles. Only known woodpecker to cover stored food with bark or wood.

Timber rattlesnake
The range of the timber rattlesnake, (*Crotalus horridus*), extends from southern New Hampshire, south to northern Florida, and west to Texas (Green and Pauley 1987, Wilson 1995).

Forested areas consisting of second-growth deciduous or coniferous forests with high rodent populations provide excellent habitat for this species (DeGraaf and Yamasaki 2001), and rocky areas with southern exposure allow maximum exposure to the sun during the spring and fall (Green and Pauley 1987, Mitchell 1994, Wilson 1995.

After emergence from dens in the spring (April-May), rattlesnakes remain close to the den until after shedding (Galligan and Dunson 1979). Brown (1993) recognized the importance of "transient habitat", a habitat that is distinct from the den and summer-range habitat. This habitat is usually within 650 ft. of the den site, and largely consists of more open, grassy woodlands with numerous rocky surfaces.

Outside of the winter den, males and non-gravid females prefer forested habitat with >50% canopy closure, thick ground and shrub vegetation (approximately 75%), and low coarse woody debris cover

(Reinert and Zappalorti 1988).

The diet of the timber rattlesnake primarily consists of small mammals such as mice and voles, squirrels, chipmunks, rabbits, bats, songbirds, frogs, and other snakes (Keenlyne 1972, Mitchell 1994, Degraaf and Yamasaki 2001).

The short and cool active season in the Appalachians places constraints on the growth and reproduction of timber rattlesnakes (Martin 1993). Male timber rattlesnakes reach sexual maturity from 4-7 years of age (Aldridge and Brown 1995), while females reach sexual maturity from 6-11 years (Brown 1993, Martin 1993).

In the Appalachian Mountains, mating occurs in the late summer (August-September), and ovulation takes place in late May and early July the following year. The gestation period is 5½ to 6 months, and 6 to 17 young are born in late August- October (Galligan and Dunson 1979, Brown 1993, Martin 1993). Timber rattlesnakes in the Appalachian Mountains do not reproduce every year, rather reproductive intervals ranged from 2-4 years with the proportion of reproductive females varying from 31-80% annually (Martin 1992, Brown 1993, Martin 1993).

A Noctuid moth

Information is extremely limited on this species. Literature search have resulted in little to no life history regarding this specie. It is known that the host plant is starry campion *(Silene stellata).* Botany surveys completed in August 2009, did not record any of these plants that would be an indicator for this species. Because of the lack of specie information, it is extremely difficult to discuss effects of hydraulic liquid application on this species. Due to the extremely general habitat characteristics identified for this species, its presence cannot be ruled out.

Diana Fritillary

This species is a specialist of forested areas, in contrast to most other eastern members of the genus, which are usually found in more open areas. The Diana fritillary and its congeners feed on violets (*Viola* spp.) as larvae, with *S. diana* feeding on several woodland species. Male dianas' begin flying in late June/ July. Females emerge the first week of July thru September. Mating occurs shortly after emergence of females. Males die after mating (all disappear by September). Female butterflies lay eggs on objects along the forest floor beginning in late July continuing into September if weather is favorable. Dianas, as with all Speyeria, are univoltine (having one brood per season). Eggs hatch about 4 weeks later and the tiny larvae crawl to a secure place and remain dormant for the winter. In spring, larvae seek out young violet leaves and begin feeding. Feeding continues till pupation. Males are typically the first to emerge in June, with females following one-and-a-half to two weeks later. Both use a variety of nectar plants as adults, and have been recorded feeding on such sources as milkweed (*Asclepias* spp.) (Opler and Krizek 1984), buttonbush (*Cephalanthus occidentalis*), coneflower (*Echinacea* spp.), and compass plant (*Silphium laciniatum*) (Moran and Baldridge 2002).

Diana fritillary populations have apparently been declining over much of their historical range, however the causes are not well known. Populations of woodland violets are healthy and in most localities, plenty of adult nectar sources are present. One possible cause of declines is the use of BT-based sprays to control gypsy moths. "BT" refers to *Bacillus thuringiensis*, a naturally occurring bacteria widely used in various types of applications as a very effective natural insecticide.

Blunt-loped grapefern

Botanical surveys conducted in August 2009. Within the proposed application area, 6 plants that may be blunt-loped grapefern were found. The identification cannot be confirmed until autumn when blunt-lobed grapefern and the look-alike species cutleaf grapefern turn distinctive colors**.**

Direct Effects

Effects to habitat – It is possible that soil salinity will increase in the application area resulting in vegetation and micro fauna dying, soil movement if spray volumes are such that soil could be detached and changes in soil pH that could result in adverse affects to flora and fauna species. According to Dewalle and Galeone 1990, if the loading rate is less than 0.7 kg Cl $m^{2,}$ the woody vegetation should not be adversely affected.

A previous application of hydraulic fluid from the B800 well at a nearby location resulted in tree and other woody vegetation mortality. If the fluid application does not go as planned, vegetation in the area may be altered immediately and for an unknown amount of time post application.

By applying the fluid over a larger area and mixing the solution to dilute it prior to application, Berry Energy is hoping to eliminate any vegetation mortality.

Effects to Individuals

Redheaded Woodpeckers are not known to occur on the Fernow Experimental Forest however no specific surveys have been completed to confirm their presence or absence. If redheaded woodpeckers reside in the application area, by September-October these birds are storing mast – acorns and beechnuts under bark, in cracks, knotholes and tree cavities for winter use. It is unlikely that they will be seen, even if present when fluid is applied as fluid application will not be occurring in the upper forest canopy. Because they are cavity nesters, direct effects of fluid application will be similar to those discussed in the Indiana bat section pertaining to runoff of spraying directly into tree cavities.

Indirectly, any additional snags or cavity trees that are inadvertently created if fluid application concentrations are high enough to kill woody vegetation in the future will indirectly improve any redheaded woodpecker habitat by providing additional snags.

Determination: May impact individuals by not likely to cause a trend to federal listing or a loss of viability.

Timber rattlesnakes are ubiquitous and can be found almost anywhere on the Monongahela National Forest during the summer months. In the fall, they gravitate towards their dens and begin mating and having young. Although there are no dens located within the 3 acre project area, a timber rattlesnake could be moving thru this area the day of fluid application. It is not certain what effects (if any) fluid application would have on any timber rattlesnake. If the applicator did see a snake the day they were spraying, it would be best if they moved away from the snake and sprayed in a different location within the 3 acres until the snake traveled thru. It is also possible that the applicator could harm or harass the snake if they are not made aware of the importance of preserving the species.

Indirectly, it is possible that local prey could be affected if fluid concentrations are too high and kill existing fauna used as a prey base. These impacts would be minimal as the area small enough that snakes could feed adjacent to the application area.

Determination: May impact individuals by not likely to cause a trend to federal listing or a loss of viability.

Noctuid moth information is limited. It is known that the larval host plant is starry campion *(Silene stellata).* Botany surveys completed in August 2009, did not record any of these plants that would be an indicator for this species. Because of the extremely general habitat characteristics identified for this species, its presence cannot be ruled out therefore, these effects will proceed as if this species does exist at this location. Hydraulic fluid application on the forest floor surface may kill existing eggs or larvae. Indirectly, if application concentrations alter forest flora enough to eliminate other host species, any noctuid moth larvae surviving the actual fluid application may not have adequate vegetation to feed on when larvae emerge in the spring.

Determination: May impact individuals by not likely to cause a trend to federal listing or a loss of viability.

Diana Fritillary eggs and subsequently the recently hatched larvae are vulnerable in September and October. It is unknown at this time, if Diana fritillary is present at the fluid application, however, these effects will proceed as if this species does exist at this location. Hydraulic fluid application on the forest floor surface may kill existing eggs or larvae.

Indirectly, if application concentrations alter forest flora enough to eliminate viola spp., any Diana larvae surviving the actual fluid application may not have adequate vegetation to feed on when larvae emerge in the spring. Similarly, nectar plants (milkweed, coneflower, compass plant, button bush) may also be affected in spring 2010 if fluid concentrations are too high.

Determination: May impact individuals by not likely to cause a trend to federal listing or a loss of viability.

Blunt-loped grapefern may be affected by the briny well fluids if the fluids were to contact the plants or infiltrate the soil in which the plants are growing. These effects will be eliminated by avoiding these plants and also providing a buffer area around the plants. The size and shape of the buffer will be determined through further consultation with the Forest Geologist after consideration of the slope and topography of the proposed application site.

Determination: May impact individuals by not likely to cause a trend to federal listing or a loss of viability.

Cumulative effects

Because of the scale and scope of this project, the low potential for direct and indirect effects on the species or habitats identified in this analysis, the lowered brine concentration in the liquid to be applied and the surface area in association with total gallons of liquid to be applied, cumulative effects to these species is discountable for all RFSS discussed in this report.

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