



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Northeast Regional Office
300 Westgate Center Drive
Hadley, Massachusetts 01035-9589

March 10, 2006

MEMORANDUM

To: Assistant Regional Director – Federal Activities
Assistant Regional Director – Refuges
Field Supervisors – NEFO, NJFO, NYFO, PAFO, CBFO
Regional Endangered Species Coordinator

From: Assistant Regional Director, ES

Subject: Appendable Biological Opinion on Bog Turtle Habitat Restoration Practices

The attached biological opinion documents intra-Service consultation on three practices that may be used to restore and maintain habitat of the threatened northern population of the bog turtle (*Clemmys (Glyptemys) muhlenbergii*). This document provides compliance with section 7(a)(2) of the Endangered Species Act (ESA) for implementation of these practices as part of a project conducted or funded, in whole or part, by the U.S. Fish and Wildlife Service (e.g., Partners for Fish and Wildlife Program, Federal Aid Program, Endangered Species Program, National Wildlife Refuges). Independent implementation of such practices by other Federal agencies is not contemplated by this document, but inter-agency section 7 compliance documents may incorporate by reference any appropriate part of this document.

It is anticipated that analyses for restoration grazing and other habitat restoration practices will be appended to this document in the future. In each case, a description of the subject practice, its effects on the bog turtle, the Service's biological opinion as to whether the practice will jeopardize the bog turtle's survival and recovery, and an incidental take statement will be included, following the format used below. In some cases, individual projects that depart from the attached descriptions or that use more experimental methods may receive independent section 7 reviews, incorporating by reference any relevant portions of this document. Furthermore, nothing in this biological opinion should be construed to discourage site-specific planning that might be conducted to maximize benefits of a habitat restoration project in accordance with section 7(a)(1) of the ESA.

Questions regarding the specific practices addressed in this opinion should be directed to Endangered Species Program personnel at the Field Office covering the area where projects are proposed.

BIOLOGICAL OPINION

**EFFECTS OF THE IMPLEMENTATION
OF HABITAT RESTORATION PROJECTS
ON THE NORTHERN POPULATION OF THE BOG TURTLE**

**CONNECTICUT, DELAWARE, MARYLAND,
MASSACHUSETTS, NEW JERSEY, NEW YORK AND PENNSYLVANIA**

Prepared by:

**U.S. Fish and Wildlife Service
Region 5 – Ecological Services**

March 10, 2006

TABLE OF CONTENTS

Biological Opinion	1
Description of the Proposed Action	1
Action Area	1
Status of the Species and Aspects of the Rangewide Environmental Baseline Pertinent to Habitat Restoration Activities	1
Practices Not Likely to Adversely Affect Bog Turtles	5
Proposed Practices and Their Effects	7
Installation of Fencing to Facilitate Grazing	8
Herbicide Application	12
Cutting and Removal of Woody Vegetation	21
Implementation of Multiple Restoration Practices	27
Cumulative Effects	28
Summary Conclusion	28
Incidental Take Statement	29
Amount or Extent of Take	30
Effect of the Take	31
Reasonable and Prudent Measures	31
Terms and Conditions	31
Conservation Recommendations	32
Reinitiation Notice	32
Literature Cited	34
Appendix A – Glossary of Terms	37
Appendix B – Animal Unit Equivalents	39

BIOLOGICAL OPINION

This biological opinion is based on information provided in the *Bog Turtle (Northern Population) Recovery Plan* as well as other information available in Service files. A complete administrative record of this consultation is on file at the U.S. Fish and Wildlife Service's Pennsylvania Field Office.

DESCRIPTION OF THE PROPOSED ACTION

The northern population of the bog turtle (*Clemmys (Glyptemys) muhlenbergii*) faces three primary threats: 1) habitat loss, degradation and fragmentation due to development; 2) habitat degradation due to succession and invasive exotic plant species; and 3) illegal collection. The Service is actively involved in addressing all three threats in implementing its consultation, recovery, and law enforcement authorities under the Endangered Species Act. This opinion addresses the Service's role in implementing, or funding the implementation of, habitat restoration activities to counter the threat of habitat succession and invasive exotic plant species. The recovery plan for the northern population of the bog turtle identifies controlling succession and invasive exotic plants (task 6.3.1) as a priority 1 recovery action (USFWS 2001). Methods of control vary depending upon the target plant species, and may include chemical control (herbicides), biological control (*e.g.*, introduction of insects, grazers), burning, mechanical or manual removal.

ACTION AREA

The action area affected directly and indirectly by bog turtle habitat restoration projects employing practices considered in this biological opinion includes wetlands in the seven-state northern range of the bog turtle. These states include: Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York and Pennsylvania. Wetlands subject to restoration will vary in size, but all are undergoing invasion by woody and/or invasive herbaceous vegetation. The action area also includes upland areas immediately adjacent to these wetlands.

STATUS OF THE SPECIES AND ASPECTS OF THE RANGEWIDE ENVIRONMENTAL BASELINE PERTINENT TO HABITAT RESTORATION ACTIVITIES

The northern population of the bog turtle, which occurs in seven states ranging from Massachusetts to Maryland, was added to the list of threatened species in 1997. Primary threats to the bog turtle are loss, fragmentation, and degradation of its fragile, early successional wet-meadow habitat, and collection for the wildlife trade (USFWS 1997). Critical habitat has not been designated for this species because identifying site locations could serve to facilitate and exacerbate illegal collection of bog turtles.

Bog turtles are semi-aquatic and only active from April to mid-October in the northern part of their range (Barton and Price 1955, Arndt 1977, Nemuras 1967). Bog turtles hibernate from October to April, often just below the upper surface of frozen mud or ice (Chase *et al.* 1989). Their varied diet consists of slugs, beetles, lepidopteran larvae, caddisfly larvae, snails, nematodes, millipedes, fleshy pondweed seeds, sedge seeds, and carrion (Barton and Price 1955,

Nemuras 1967). Bog turtle densities range from 7 to 213 per hectare (Chase *et al.* 1989). They usually occur in discrete populations occupying suitable habitat dispersed along a watershed (Collins 1990).

Bog turtles typically inhabit shallow spring-fed fens, sphagnum bogs, swamps, marshy meadows, and pastures with soft muddy areas. These emergent wetlands are usually a mosaic of shallow water, soft muddy bottoms, low grasses and sedges, and interspersed wet and dry pockets. Spring-seeps often form a network of small rivulets in the wetland. The open canopy of these wetlands provides sunlight for basking and nesting, and is essential for continued use by bog turtles. The shallow water and deep “mucky” soils (see *Glossary*) are crucial bog turtle habitat components. Burrowing under the muck is the species’ primary anti-predator defense mechanism.

Bog turtle habitats are sustained primarily by groundwater, although surface water also contributes to wetland maintenance. Bog turtles depend upon relatively stable, year-round supplies of clean groundwater to support their food base, brumation (hibernation) and aestivation areas, and their nesting habitat. Soft substrates and slow moving water both above and below the surface protect the bog turtles against freezing and overheating. Ernst *et al.* (1989) reported on bog turtle hibernation sites in New Jersey and Pennsylvania. They found turtles hibernating in spring-fed rivulets under soft mud, in muskrat burrows, under sedge clumps, at the base of tree stumps, and in meadow vole burrows. Morrow reported finding 17 bog turtles and one spotted turtle in a communal hibernaculum in Harford County, Maryland (S. Smith *in litt.* 2000).

Female bog turtles reach sexual maturity between 5 and 8 years of age (Barton and Price 1955, Ernst 1977). Mating occurs in May and June, and females deposit from two to six white eggs in sphagnum moss or sedge tussocks in May, June, or July (Arndt 1977, Herman 1990, Herman and George 1986). The eggs hatch after an incubation period of 42 to 56 days (Arndt 1977, Herman 1990), and the young emerge in August or early September (Arndt 1977, Barton and Price 1955). Infertile eggs are common (Arndt 1977, Herman 1990, Tryon 1990), and not all females produce clutches annually (Tryon 1990). There is no evidence to suggest that multiple clutches are deposited in a single season.

Bog turtles inhabit sub-climax seral wetland stages and are dependent on riparian systems that are unfragmented and sufficiently dynamic to allow the natural creation of meadows and open habitat to compensate for the closing over of habitats caused by ecological succession. Succession of many wetlands from open-canopy fens to closed-canopy red maple (*Acer rubrum*) swamps contributes to the loss of bog turtle habitat. Spread of exotic invasive vegetation, including common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), multiflora rose (*Rosa multiflora*), and reed canary grass (*Phalaris arundinacea*), also degrades bog turtle habitat in many locations. Soil disturbance and roads often provide avenues for the introduction or spread of invasive native and exotic plants.

Based upon documented losses of bog turtles and their habitat, the northern population has declined by at least 50 percent, with most of the documented decline occurring over the past 20 years. Significant declines are likely to have occurred prior to this due to the filling and draining of wetlands. As of 2000, there were 360 known extant bog turtle sites (referred to as population

analysis sites, or PAS's) within the range of the northern population. Due to widespread wetland habitat fragmentation throughout the bog turtle's range, however, many sites consist of only one small, marginally viable, extant occurrence, often isolated from other such occurrences and under threat of development (USFWS 2000, p. 5).

Habitat loss (*i.e.*, via destruction, degradation, and fragmentation) and illegal collecting for the pet trade are the primary threats to the species. Direct habitat loss or degradation has occurred from the draining, ditching, dredging, or filling of suitable sites for agricultural use, development, and pond or reservoir construction. The proximity of many remaining bog turtles to roadways and population centers exposes these populations to increased predation, road kills, pollution, and establishment of invasive native or exotic plant species which pose a significant indirect threat to the species. The eggs and young bog turtles are particularly vulnerable to predators such as raccoon, opossum, skunk, fox, snapping turtle, water snake, and larger birds. Populations of many of these predators are elevated in areas of high human activity.

The bog turtle is also vulnerable to local extirpation and range-wide reduction due to the small size and isolation of many populations, delayed sexual maturity, low juvenile recruitment, low mobility, and small home range (Arndt 1977, Chase *et al.* 1989). Population modeling and sensitivity analysis show that the viability of turtle populations is far more dependent on adult survivorship than hatchling survivorship. Many species models show that the added loss of even one adult at a site may compromise the survival of that population (Alison Whitlock, USFWS, personal communication). In addition, the isolation of populations limits gene flow which could result in inbreeding depression. Furthermore, isolation and habitat fragmentation prevent the recolonization of existing habitat where populations have declined or disappeared, as well as expansion and colonization of newly created habitat (62 FR 59620).

As of 2005, bog turtles have been documented at approximately 475 sites (Table 1), ranging in quality from good to poor, within the northern range. These represent individual wetlands, or in some cases road crossing sightings, where the species has been confirmed. These sites or occurrences are not equivalent to the "population analysis sites" or sub-populations referred to in the bog turtle recovery plan. In some cases, sites are close enough together to allow turtle movement between wetlands; therefore, the clustering of multiple sites or occurrences into sub-populations (population analysis sites) would better reflect the species status.

Multi-year, mark-recapture studies have only been conducted at a few sites rangewide. However, based on the finding of only old individuals at some sites and the degraded condition of existing habitat at many locations, many sites are thought to support small numbers of turtles – probably between 15 and 30. This places the population estimate for the species in its northern range at about 10,000 individuals. Considering the species low reproductive potential and small sub-population numbers, it is critical to protect mature adults and attempt to boost nesting success to prevent further population declines.

Table 1. Bog Turtle Occurrences in the Northern Range

State	Counties of Occurrence	Estimated Number of Occurrences
Connecticut	1	3
Delaware	1	5-8
Maryland	4	98
Massachusetts	1	3
New Jersey	11	200
New York	11	65
Pennsylvania	15	100
TOTAL	44	475

In an effort to address the threats posed by habitat succession and invasive species, habitat restoration activities have been undertaken throughout the northern range of the bog turtle. A state-by-state summary of recent habitat restoration activities is presented below.

Delaware – All of Delaware’s sites are threatened by invasive species and/or natural succession. One landowner conducts regular mowing to control multiflora rose and uses herbicides to manage other invasive species on the perimeter of the site. Efforts to obtain management agreements with other landowners are in progress.

Connecticut – All three Connecticut sites are dominated by early successional and invasive species. Purple loosestrife, common reed and red maple are the primary concerns at these locations. Only one location has received vegetation management treatments.

Maryland – Of 112 Maryland bog turtle wetlands assessed for invasive species between 1993 and 2004, 29 wetlands had 51 to 75 percent invasive species cover, while invasive species cover at 17 wetlands was greater than 75 percent. Habitat restoration activities have been conducted at 17 Maryland bog turtle wetlands totaling more than 150 acres since 1997. Restoration at many, if not most, of these sites will require follow-up maintenance.

Massachusetts – Two of three sites in Massachusetts that were referenced in the 2001 recovery plan have undergone limited treatment for invasive and successional species during the past several years. Invasive species cover is at 50 to 75 percent – with red maple, *Phragmites* and reed canary grass being the predominant threats. The third site is within a pasture which reportedly receives periodic light grazing. This site has not been visited in recent years and the status of invasive or successional species is not presently known.

New Jersey – Approximately 74 percent of known sites have some degree of habitat degradation, such as succession by woody vegetation, invasive species, or a combination of both. The New Jersey Endangered and Nongame Species Program with support from USDA initiated habitat restoration activities at approximately 68 percent of degraded sites (over 100 sites). Thirty-nine sites have been managed for woody vegetation (red maple, alder, poison sumac) using the hack and squirt technique with Rodeo[®], or the cut stem technique. One hundred percent elimination

occurred for all targeted species within 1-2 applications (1-2 years). Between 1998 and 2004, 685,414 *Galerucella* spp. beetles were released at 36 bog turtle sites. Recoveries of beetles the following year after release (constitutes successful establishment of beetle) have been made at all 36 sites. Twenty active grazing projects are underway targeting *Phragmites*, reed canary grass, purple loosestrife, multiflora rose, and woody vegetation. Grazing has eliminated roughly 85 percent of *Phragmites*, purple loosestrife and multiflora rose over three years. The remainder of *Phragmites* has been controlled using the snip and drip technique (applying Rodeo® to the cut shoot). Reed canary grass has been grazed to a low height; it is nearly impossible to eliminate (Zarate, pers. comm., 2005).

New York – Of approximately 65 known extant bog turtle sites, generally all have some degree of habitat degradation through either succession or invasive species encroachment. With the assistance of USDA, habitat restoration and management has been initiated or is planned to begin within a year at 16 sites. Techniques include *Galerucella* spp. beetle release, manual vegetation removal, herbicide application, tree girdling, and grazing using cows, goats, and/or sheep. Vegetation monitoring will occur at all sites and bog turtle habitat use is being studied pre- and post-restoration using radio-telemetry at a sample of restoration sites.

Pennsylvania – Many bog turtle sites in Pennsylvania have been degraded by red maple, reed canary grass, and *Phragmites*. Purple loosestrife and multiflora rose also pose a threat to bog turtle habitat, but to a lesser degree at this time. Over the past few decades, it appears that the elimination of grazing on an increasingly suburban landscape has allowed invasive plants and woody vegetation to over-take the open, emergent wetlands favored by bog turtles. The Service's Partners for Fish and Wildlife Program has installed fencing at three bog turtle sites, facilitating the introduction of grazing and restoration of habitat. Woody vegetation control using mechanical or chemical treatment has occurred at several sites, opening up the canopy and restoring emergent wetland conditions suitable for bog turtles. Habitat restoration projects have also been undertaken by various conservation partners, including the Berks County Conservancy, The Nature Conservancy, and Environmental Defense.

PRACTICES NOT LIKELY TO ADVERSELY AFFECT BOG TURTLES

During previous informal consultations (e.g., between Endangered Species Program and Partners for Fish and Wildlife Program biologists), the following habitat restoration practices have been determined not likely to adversely affect bog turtles, and have been excluded from the formal consultation process. These practices have been and will continue to be implemented to restore bog turtle habitat, and their effects are expected to be wholly beneficial. Project proposals that involve only these habitat restoration practices do not require any additional review so long as no activities beyond those described here are undertaken in the wetland. If information becomes available indicating that any of these practices may have an adverse effect on bog turtles, consultation on the practice(s) will be initiated.

- A. Installation of fencing in upland areas to facilitate “light to moderate grazing” (see *Glossary*).

- B. Hand-installation of fencing in wetlands at any time of year to facilitate “light to moderate grazing” (see *Glossary*). Prior to hand installation, a “monitoring biologist” (see *Glossary*) will search the wetland work areas (e.g., surface and substrate where the fence posts will be placed, access routes through the wetland) to ensure that bog turtles are not present. No vehicles will be used in the wetland.
- C. Installation of interior, partition fencing or movement of such fencing within wetlands at any time of year. Interior, temporary fencing is supported by small-diameter (not to exceed one inch in diameter), hand-placed poles (e.g., 1-inch diameter fiberglass rods).
- D. Prescribed burning in wetlands between November 1 and March 31. Some of the dead emergent vegetation in mucky areas of the wetland will remain unburned to provide cover for bog turtles when they emerge in the spring.
- E. Introduction of biological control beetles (i.e., *Galerucella californiensis* and *G. pusilla*) in wetlands to control purple loosestrife (*Lythrum salicaria*).
- F. Application of glyphosate (following label directions) in uplands adjacent wetlands occupied by the bog turtle. This refers specifically to the application of glyphosate to control invasive plant species problematic to the bog turtle (e.g., multiflora rose, mile-a-minute weed), provided there is no application of herbicide in the wetland.
- G. Girdling of woody vegetation in or adjacent to wetlands. Approximately 10-20 percent of the tree and shrub cover in “mucky areas” (see *Glossary*) of the wetland will be retained (i.e., not treated), especially alder, red maple and poison sumac located in or near seeps, springs, rivulets and mucky areas. These areas will be clearly marked or flagged to avoid treatment.
- H. Cutting and/or removal of woody vegetation ≤ 3 inches in diameter at breast height (d.b.h.) between October 1 and March 31 using light equipment (e.g., chainsaw, ax – see *Glossary*). No vehicles will be used in the wetland.

Note: Cutting done outside this window, cutting of larger d.b.h. vegetation, and cutting that is followed by herbicide application are practices that may affect bog turtles. Therefore, these practices, along with conservation measures to minimize take, are included in this biological opinion under Cutting and Removal of Woody Vegetation.

- I. “Light to moderate grazing” (= habitat maintenance grazing) within wetlands. In the final listing rule for the bog turtle, the Service recognized the beneficial effect of grazing in controlling succession and maintaining bog turtle habitat. While grazing could potentially result in the death or injury of bog turtles due to trampling, this effect was considered to be “discountable” (i.e., extremely unlikely to occur). Therefore, the Service determined that “light to moderate livestock grazing that prevents or minimizes the encroachment of invasive native and exotic plant species” is an activity that will not result in a violation of section 9 of the Endangered Species Act (*Federal Register*, Vol. 62, No. 213, p. 59621).

For the purpose of this opinion, “light to moderate grazing” is defined as grazing using a stocking density of up to 0.75 animal units per acre of “grassland” within the fenced enclosure. “Grassland” is defined as open, grassy areas such as areas with emergent wetland vegetation (*e.g.*, sedges, rushes); upland pasture grasses (*e.g.*, fescue, timothy); or invasive, exotic plants (*e.g.*, *Phragmites*, reed canary grass). This stocking density is equivalent to one dairy cow per two acres, four sheep per acre, or five goats per acre of grassland within the fenced enclosure. See Appendix B for an animal unit equivalents guide. Grazers have access to both upland and wetland areas, and large grazers (see *Glossary*) are excluded from known nesting areas during the bog turtle nesting season (June 1 to September 30).

Although there have been documented cases of cattle stepping on and killing or injuring bog turtles (Herman 2005), the risk of this happening is very small when the density of large grazers (*e.g.*, cattle, horses) is low and when those grazers also have access to upland areas. Under these conditions, grazers are not in the wetland continuously, and when they are present in the wetland, they are there at a low density. In addition, large grazers (see *Glossary*) will be excluded from known nesting areas during the nesting season (June 1 to September 30), further minimizing the risk to turtles and their nests. When grazing is carried out in the manner described above, the risk of take is considered by the Service to be discountable (*i.e.*, extremely unlikely to occur).

PROPOSED PRACTICES AND THEIR EFFECTS

The following practices are proposed to restore or maintain bog turtle habitat to further the recovery of the species. These practices are expected to have a beneficial effect, but due to the use of heavy equipment or herbicides, there is also the potential for adverse effects¹.

In order to minimize the risk of take, each habitat restoration/maintenance practice includes conservation measures. Conservation measures represent actions pledged in the project description that the action agency or the applicant will implement to reduce or mitigate adverse effects. The beneficial effects of conservation measures are taken into consideration in the Service's conclusion of jeopardy or non-jeopardy to the listed species, and in the analysis of incidental take.

The intent of each of the practices listed below is to restore or maintain bog turtle habitat. Therefore, each practice represents a conservation activity consistent with the habitat restoration and maintenance task in the bog turtle recovery plan (task 6.4). In addition, practice-specific conservation measures have been incorporated into the project description for each of the

¹ In the past, some project-specific analyses have determined that practices similar to those described here were not likely to adversely affect bog turtles because all the potential direct and indirect effects were beneficial, discountable, and/or insignificant. As a result, no incidental take monitoring was conducted. Although it is likely that these practices would similarly be found not likely to adversely affect bog turtles in many future project-specific analyses, in the interest of expediting future restoration projects, the Service has elected to presume that the potential for adverse effects warrants formal analysis, formulation of a biological opinion, and an incidental take statement.

proposed practices. These measures are designed specifically to avoid and minimize impacts of the proposed action on the bog turtle. The Service has analyzed the effects of the proposed practices based on the assumption that all conservation measures will be implemented. Implementation of the conservation measures will minimize the risk of take, ensuring the beneficial effects of habitat restoration will offset the risk of undertaking these activities. The specified duties of the monitoring biologist are especially important to assuring the effective implementation of the conservation measures and consistency of projects with all aspects of this opinion.

Because some of the habitat restoration and maintenance practices discussed in this opinion are just beginning to be implemented in known bog turtle habitat within the species' northern range, the effects of these practices on both the bog turtle and its habitat will be re-evaluated as projects are completed. This opinion considers the effects of implementing the following practices over a 5-year time period, from 2006 to 2010, after which the practices and their effects will be re-evaluated to determine whether they continue to be consistent with this opinion and the recovery needs of the species.

1. Installation of Fencing to Facilitate Grazing

Project Description – To facilitate the introduction and/or management of grazers, fencing will be installed to provide an appropriate amount of pasture. In most cases, both upland and wetland areas will be made available to grazers. Fence posts will typically be installed with a fence post pounder attached to a tracked or wheeled vehicle, such as a skid steer. Vehicles will typically make a single pass over the route of the fence alignment when installing fencing. Vehicles that exert low ground pressure will be used whenever possible to minimize soil disturbance and compaction. Use of this equipment allows posts to be quickly and efficiently driven deep into the substrate, below the frost line to ensure the posts remain in place. Fencing will be installed to facilitate “light to moderate grazing” (maintenance grazing – see *Glossary*) or restoration grazing that may be considered in a future amendment to this biological opinion.

Conservation Measures – To minimize the risk of take, the following conservation measures will be implemented in wetlands occupied by bog turtles.

1. *Stocking density* – The Service will only install or fund the installation of fencing to facilitate habitat maintenance grazing (see *Glossary*) or habitat restoration grazing done in accordance with future amendments to this document. The Service will make landowners or grant recipients aware (*e.g.*, via the Partners landowner agreement or Federal Aid contract) of the need to remain within these stocking densities to avoid unauthorized incidental take. The landowner will also be made aware of the need to exclude large grazers (see *Glossary*) from known nesting areas during the nesting season (see Conservation Measure 9). Known nesting areas are areas where bog turtle nests have been found.

2. *Role of monitoring biologist*

- Prior to fence installation, a monitoring biologist (see *Glossary*) will walk through the wetland to identify and clearly mark and map “mucky areas” (see *Glossary*), particularly along the proposed fence alignment. The monitoring biologist will work with the project proponent to avoid or minimize encroachments into mucky areas when laying out the fence alignment.
- Prior to fence installation, the monitoring biologist will identify and clearly mark and map known nesting and hibernating areas. The markings used to identify these sensitive areas will be removed when the project is completed.
- The monitoring biologist will help to identify the most appropriate travel routes (see *Glossary*) for heavy equipment within the wetland. These travel routes will avoid mucky areas and known nesting and hibernating areas.
- A monitoring biologist will be present on site the first day restoration activities are undertaken to brief workers on the conservation measures, and ensure that sensitive areas are clearly marked and avoided. In addition, the monitoring biologist will conduct site inspections periodically during restoration to ensure that the conservation measures are being implemented appropriately.

3. *Project description and map* – After the site has been field-viewed to determine which restoration activities are necessary and appropriate, a detailed project description, project location map, and site map will be prepared. The project location map will identify the project’s location on a USGS topographic map. The site map will identify the property boundaries, wetland boundaries, *known* nesting and hibernating areas, “mucky areas”, and the proposed fence alignment in the wetland and upland. The project narrative will include information about the type and density of grazers, the acreage of wetland and acreage of upland to be fenced, and short and long-term grazing objectives. This information will be submitted to the Fish and Wildlife Service (*e.g.*, Private Stewardship Grants) or appropriate state wildlife agency (*e.g.*, State Wildlife Grants, Landowner Incentive Program Grants) for review and approval. In the case of projects implemented by the Partners for Fish and Wildlife Program, this information will be retained in their project files.

4. *Spill avoidance* – To reduce the risk of spills within the wetland, vehicles and heavy machinery will be serviced in upland areas. When it is necessary to fuel light equipment (chainsaws, hand-held power augers, etc.) in the wetland, absorbent pads will be used to catch and contain any spills.

5. *Siting posts*

- Wherever possible, fence posts will be installed in upland areas. Where this is not feasible (*e.g.*, where it is necessary to install fencing within the wetland due to the

location of property boundaries), fence posts will be installed in non-mucky areas within the wetland whenever possible.

- Fence post placement in mucky areas will be avoided or minimized to the extent possible. When it is necessary to install fence posts in mucky areas, small-diameter, hand-set posts (*e.g.*, fiberglass rods) will be used whenever possible.

6. *Installing fencing using heavy equipment (see Glossary)*

- When it is necessary to install fence posts in wetlands using tracked or wheeled vehicles, installation will occur between November 1 and March 31.
- Wheeled or tracked vehicles/equipment will not be used in or driven through mucky areas unless there is sufficient frozen ground, or snow/ice cover to support the weight of the vehicle (*i.e.*, to prevent the vehicle's tires or tracks from sinking more than 2 to 4 inches into the soil).
- If fence posts must be installed in mucky areas, and there is insufficient frozen ground or snow/ice cover to support the weight of the vehicles typically used to install the posts, the posts will be installed by hand using hand-held equipment (*e.g.*, hand-operated augers).
- Heavy equipment will use pre-determined travel routes when working in the wetland. Travel routes will avoid mucky areas and known nesting and hibernating areas.

7. *Installing fencing by hand.* When fencing will be installed in the wetland by hand (*i.e.*, using light equipment such as hand-operated augers), installation may occur at any time of year. In cases where fencing is installed in uplands or where a monitoring biologist is available to inspect work areas in wetlands, the hand-installation of fencing is an activity that is not likely to adversely affect bog turtles.

8. *Known nesting areas.* Fencing will be installed to exclude large grazers (see *Glossary*) from known bog turtle nesting areas during the nesting season (June 1 to September 30). In most cases, this will be done by the landowner using temporary, partition fencing.

9. *Known hibernacula.* All known hibernacula will be clearly marked, and vehicles will not be driven over or within 50 feet of known hibernacula. In addition, fence posts will not be installed in or immediately adjacent to known hibernacula.

Effects of the Action – Fencing allows landowners to manage the location and numbers of grazers. Fences required to manage grazers must cross wetlands containing bog turtles in a variety of circumstances, such as where the entire wetland is larger than the restoration area, where wetlands cross property boundaries, or where fencing is necessary to keep grazing animals

from entering another part of the wetland (e.g., riparian buffer, forested wetland, bog turtle nesting area).

Indirect beneficial effects include maintenance of intermediate stages of native plant succession that support optimal densities of bog turtles. The bog turtle recovery plan (p. 13) indicates that grazing by domestic livestock in bog turtle wetlands has “either replaced grazing by native herbivores or replaced one of the other historical factors (e.g., beaver, fire) that would have acted to maintain the wetlands in an early successional stage.” Grazers are able to maintain wetlands in an emergent condition by grazing on competing invasive vegetation and breaking up the root system of invasive species, such as reed canary grass. This maintains open areas within the wetland for nesting, basking and escape cover. Improvements in bog turtle habitat conditions following introduction of grazers at several New Jersey sites is described by Tesauro (2001).

The risk of take is extremely low when grazing is done in accordance with the “light to moderate grazing” guidelines. During bog turtle surveys in North Carolina over the past 30 years, where many sites are actively grazed, Herman (2005) reported that he had found or seen over 1500 bog turtles of which less than 10 were definitely injured by livestock. Two were killed and the others had old healed-over injuries that he assumed were caused by trampling. Based on his field surveys, the observed death and injury rate was 0.67 percent of the located turtles. The actual rate may be slightly higher because dead turtles would not be expected to persist in the wetland due to scavengers. Nevertheless, any adverse effects appear to be discountable. Adherence to the grazing guidelines will ensure that effects remain at the “discountable” level.

The installation of fencing to support grazing poses a direct risk of injury or death to turtles, but the conservation measures listed above will substantially reduce that risk. In most cases, at least part of the fencing will be installed in uplands, avoiding any impacts to bog turtles. When it is necessary to install fencing in wetlands using heavy equipment (see *Glossary*), it will be installed between November 1 and March 31, when bog turtles are hibernating (brumating) or concentrated near their hibernation areas. These are areas of the wetland having soft saturated soils and/or subsurface tunnels, along with appropriate hydrological conditions (springs, seeps, subsurface flow) to prevent the turtles from freezing. Although the locations of these hibernacula will not usually be known prior to project implementation, the risk of take will be minimized by limiting access to areas of the wetland that are potentially suitable for hibernation (i.e., mucky areas). These potential hibernating areas will be avoided whenever possible. When these areas cannot be avoided, they will only be accessed when there is sufficient snow cover, ice cover, or frozen ground to support the weight of the tracked or wheeled vehicles used to install the fence posts.

Driving equipment through the wetland to install fencing is safer when turtles are hibernating, because during this period turtles are concentrated in the areas of the wetland where vehicle use is restricted. In addition, the vehicle installing the fencing is expected to make a single pass through any mucky areas along the fence alignment. A single pass reduces the risk of breaking through the snow/ice cover.

Despite implementation of these conservation measures, there remains some risk of take. In situations where it is necessary to install fence posts in mucky areas, it is possible that a post(s)

will hit and kill or injure one or more hibernating turtles. If tracked or wheeled vehicles are driven through mucky areas – accidentally, intentionally or because the mucky areas were not carefully delineated prior to project implementation – hibernating turtles could be crushed (killed), injured, or displaced from their hibernacula, placing them at an increased risk of death. This could also occur if vehicles break through the snow/ice cover over mucky areas supporting hibernating turtles. If a hibernating turtle is displaced from its hibernaculum due to fence post installation or vehicle use in mucky areas, the turtle may avoid immediate death/injury but have to re-position itself in an appropriate hibernating location. If it has been forced to the surface, a combination of cold temperatures and slow body metabolism may prevent it from successfully locating an appropriate hibernating spot, leading to death.

The installation of fencing by hand also poses some (albeit low) risk if a monitoring biologist is not present to inspect the project area for turtles prior to work activities. When fencing is installed during the bog turtle active season (approximately April to mid-October), turtles may be present anywhere in the wetland. Bog turtles could be killed or injured, or their nests could be damaged as fencing materials are transported to work areas or as posts are installed. However, the risk of hand installation is quite small considering the size of the disturbance area relative to the wetland.

Conclusion – Careful implementation of the conservation measures is expected to substantially reduce the risk of installing fencing in wetlands occupied by the bog turtle. When the small risk of injuring or killing a bog turtle during installation of fencing is balanced against the benefits of grazing to maintain wetland conditions that favor bog turtles or reverse the effects of invasive vegetation, it is clear that this activity will produce a net benefit to the bog turtle and is not likely to jeopardize its continued existence. No critical habitat has been designated for the bog turtle; therefore none will be affected.

Incidental Take Statement – It is anticipated that, on average, up to one bog turtle will be killed or injured for every ten sites fenced where heavy equipment (*i.e.*, tracked or wheeled vehicles) is used in the wetland.

2. Herbicide Application

Project Description – In some situations, the application of glyphosate (*e.g.*, Rodeo[®]) or imazapyr (*e.g.*, Habitat[®]) will be carried out to control invasive species that are degrading the quality of the bog turtle's wetland habitat. This opinion contemplates the use of imazapyr to control woody vegetation using the injection application method, as described below. This opinion also contemplates the application of glyphosate using various methods to control the following invasive exotic and native species in bog turtle wetlands: *Phragmites*, purple loosestrife, cattail, red maple, alder, poison sumac, and multiflora rose. Over time, these species can form monotypic stands and in the case of woody vegetation, further accelerate succession and make the wetland drier. As a result, valuable nesting and basking habitat is lost and escape cover is reduced.

This opinion contemplates the use of glyphosate to control cattail when that species has become the dominant plant species in the wetland (*i.e.*, when cattails cover ≥ 50 percent of the emergent

part of the wetland). However, *elimination* of cattail is not a treatment objective. Cattail is considered an important component of bog turtle habitat. Bog turtles have been documented to select cattail patches, presumably for their shade and the relatively high-density slug populations that are often found on the lower stems of the plants. Therefore, in most cases, cattail is not considered a target species for control efforts. When it does appear that cattail cover within a wetland is increasing, it may be a sign that sediment and/or nutrient inputs have increased, giving this species a competitive advantage (Scott Smith, Maryland DNR, personal communication). If this is the case, these input sources should be addressed. If it has been determined that measures should be implemented to control cattail, the preferred treatment method is grazing. Cattle preferentially graze cattail and reduce cattail cover by breaking up the roots with their hooves. When grazing cannot be used, patches of cattail may be treated using glyphosate as a last resort control measure.

This opinion contemplates specific methods of glyphosate and imazapyr application in wetlands occupied by bog turtles, as detailed below. The application methods are consistent with those discussed in The Nature Conservancy's *Weed Control Methods Handbook: Tools & Techniques for Use in Natural Areas* (Tu *et al.* 2001) and *Safe Herbicide Handling in Natural Areas: A Guide for Land Stewards and Volunteer Stewards* (Hillmer and Liedtke 2003). Further details about these methods and their applicability can be found in Chapter 5 and on pages 5-13 of the subject publications, respectively. Both handbooks can be found at <http://tncweeds.ucdavis.edu>.

This opinion does not contemplate the use of other application methods (*i.e.*, that are not described below, such as soil application of herbicide); use of the described methods on target plant species that are not listed; or use of these methods outside the specified treatment periods.

Herbicide Treatment Methods

➤ Injection

- This method involves the injection of pellets of glyphosate or imazapyr directly into the trunks of woody vegetation.
- Treatment period – In accordance with EPA-approved label instructions
- Application tool – an E-Z-Ject® Lance (or equivalent)
- Injection of pellets containing imazapyr will be limited to stem diameters exceeding two inches to minimize the risk of herbicide leaching from roots into the surrounding soil.
- Herbicide is delivered directly to woody stems, avoiding any herbicide spillage in the wetland. Little or no migration of herbicide from the root system to wetland soils is anticipated.
- Target plants – red maple, alder, poison sumac

➤ **Hack and Squirt (also Frill, Drill and Fill)**

- The trunk of the tree is cut using a sharp object (*e.g.*, knife, saw, ax) or holes are made in the trunk with a power drill or other device. Glyphosate is then immediately applied to the cut using a backpack sprayer, squirt bottle or syringe. A Hypo-Hatchet[®] Tree Injector can also be used.
- Treatment period – In accordance with EPA-approved label instructions for Glyphosate application
- Herbicide is delivered directly to cuts in woody stems; however, some spillage of herbicide may occur (from the sprayer, bottle) and herbicide may run down the treated stems into wetland soils.
- To minimize the risk of herbicide spillage, open containers of herbicide will not be used in the wetland (*e.g.*, an open container and paint brush).
- Target plants – red maple, alder, poison sumac, multiflora rose

➤ **Cut Stump (or Cut Stem)**

- The tree or shrub is cut within 6 inches of the ground, exposing a horizontal treatment surface. Glyphosate is immediately applied to the cut surface(s) using a spray bottle or wick applicator. If vegetation has been cut previously (outside the Glyphosate application period), height of the initial cutting should be adjusted to allow for subsequent re-cutting.
- Treatment period – In accordance with EPA-approved label instructions for Glyphosate application. Note that other time-of-year restrictions (described on page 24) apply to cutting of woody vegetation >3" d.b.h. (but not to re-cutting of stumps for herbicide application).
- A variation of this method is the “snip and drip” technique, which is used to treat *Phragmites*. This involves cutting the stem and then dripping glyphosate onto the cut stem. This is usually done in late summer/early fall.
- Glyphosate will be applied using a device that minimizes the risk of spillage (*e.g.*, via a hand-held spray bottle rather than a paint brush and open container of herbicide).
- Glyphosate is delivered directly to the cut stems; however, some spillage of herbicide may occur and herbicide may run down the treated stems into wetland soils.
- Target plants – red maple, alder, poison sumac, *Phragmites*, multiflora rose

➤ **Wick Application**

- This is a foliar application method, intended to deliver herbicide to the intact leaves or stem of the target plant.
- Treatment period - during the growing season, usually when plants are close to flowering
- Glyphosate is applied directly to the leaves and/or stem via the “glove application” method (see *Glossary*) or by using a “paint stick” or “stain stick” with a contained reservoir to hold the herbicide (see Tu *et al.* 2001). To reduce the risk of spills, herbicide will not be applied using an open container of herbicide.
- Because the herbicide is wicked directly onto the target plant, the risk of herbicide being spilled onto non-target plants or wetland soils is greatly reduced.
- Target plants – *Phragmites*, purple loosestrife, cattail, re-sprouts of woody vegetation (*e.g.*, red maple, alder).

➤ **Spot Spray**

- This is a foliar application method, intended to deliver herbicide to the leaves and/or stem of the target plant.
- Treatment periods – September or October for *Phragmites*; around the time of flowering for purple loosestrife (July/August); July-September for multiflora rose and woody re-sprouts; September for cattail. Later dates (post-July) are preferred whenever feasible to reduce potential impacts to nests.
- Glyphosate is sprayed onto the leaves or stem via a backpack sprayer, squirt bottle, or modified low volume hydraulic applicator. A wand will be used to ensure that herbicide reaches the tops of tall plants. High pressure sprayers will not be used, as this will increase the risk of herbicide drift.
- Herbicide drift from the sprayer can kill or damage desirable non-target plants and end up in wetland soils.
- Target plants – multiflora rose, *Phragmites*, purple loosestrife, cattail, and re-sprouts of woody vegetation (*e.g.*, red maple)

Regardless of the method used, glyphosate will be applied in a dilution appropriate for the method of application. When carrying out a foliar application of glyphosate, the surfactant LI-700® may be used in accordance with the EPA-approved label instructions to improve efficacy of the herbicide and potentially reduce or eliminate the need for re-treatment. However, a surfactant is not necessary when using the cut stump, hack and squirt, or injection method.

Spray applications of glyphosate will only be used when the target plant species occurs at a high enough density to minimize the risk of effects to non-target plants. Application will be via spray bottle, backpack sprayer, or modified low volume hydraulic applicator with hand held directed spray equipment and a PSI not to exceed 60 lb/in². Use of wheeled or tracked equipment in wetlands is not covered by this project description, but may be contemplated in a future amendment to this biological opinion or in a project specific consultation.

Conservation Measures – To minimize the risk of take, the following conservation measures will be implemented in wetlands occupied by bog turtles.

1. *Role of the monitoring biologist*

- A monitoring biologist will field-view the site and work with the project proponent to determine which restoration activities are necessary and appropriate.
- When possible, telemetry or early season surveys will be conducted to identify particular patches of woody vegetation serving as hibernacula. Such areas will not be subject to woody vegetation control. If possible, surveys will also be conducted to identify nesting areas.
- Prior to herbicide application, the monitoring biologist will identify and clearly mark and map known nesting and hibernating areas. The markings used to identify these sensitive areas will be removed immediately following herbicide application.
- A monitoring biologist will be present on site the first day restoration activities are undertaken to brief workers on the conservation measures, and ensure that sensitive areas (*i.e.*, areas to remain untreated) are avoided. All treatment areas will be clearly identified. In addition, the monitoring biologist will conduct site inspections periodically during restoration to ensure that the conservation measures are being implemented appropriately. Inspections should be more frequent if herbicides are applied when nests are active.

2. *Project description and map* – After the site has been field-viewed by a monitoring biologist (see *Glossary*), a detailed project description, project location map, and site map will be prepared. The project location map will identify the project's location on a USGS topographic map. The site map will identify the property boundaries, wetland boundaries, *known* nesting and hibernating areas, and proposed treatment areas by target plant species. The project narrative will include detailed information about the proposed treatment for each target plant species, including herbicide and surfactant type and concentration, application method, timing of treatment, and size of area to be treated. This information will be submitted to the Fish and Wildlife Service (*e.g.*, Private Stewardship Grants) or appropriate state wildlife agency (*e.g.*, State Wildlife Grants, Landowner Incentive Program Grants) for review and

approval. In the case of projects implemented by the Partners for Fish and Wildlife Program, this information will be retained in their project files.

3. *Licensed applicator* – A licensed applicator will be present on site at all times when herbicide is being applied.
4. *Spill avoidance* – To reduce the risk of spills within the wetland, the filling and emptying of herbicide containers (e.g., spray bottles, backpack sprayers) will occur in upland areas. All applicators will have available a spill kit with absorbent pads. In addition, all equipment, hoses, tanks and clamps will be inspected in the uplands prior to spraying each treatment day.
5. *Treatment area limits*
 - No more than 50 percent of the wetland will be treated in any one year period. Refer also to treatment area limitations under Implementation of Multiple Restoration Practices, page 28 of this document.
 - When controlling woody vegetation with herbicides, approximately 10-20 percent of the native tree and shrub cover in “mucky areas” (see *Glossary*) of the wetland will be retained (i.e., not treated), especially alder, red maple and poison sumac located in or near seeps, springs, rivulets and mucky areas. Scattered pockets of shrubs will be retained in mucky areas within the emergent portion of the wetland. In addition, 10-20 percent of the tree cover will be retained within the forested parts of the wetland, typically in mucky areas. These areas will be clearly marked or flagged to avoid treatment.
6. *Surfactant* – When it is necessary to use a surfactant to increase the efficacy of glyphosate, the surfactant LI-700[®] will be used in accordance with the EPA-approved label instructions.
7. *Known nesting areas* – Herbicide will not be applied within *known* nesting areas between June 1 and September 30, nor will workers traverse through known nesting areas during this period.
8. *Known hibernating areas* – Herbicide will not be applied to woody vegetation within documented hibernating areas.
9. *Consideration of other control mechanisms* – Herbicide application will not be carried out when another mechanism is controlling or likely to effectively control the target species (e.g., when multiflora rose in a wetland has already been infected by rose rosette disease, or when grazing is effectively controlling the target species).
10. *Cattail treatment* – Cattail will only be controlled with herbicides when this species has become a dominant plant species in the wetland (i.e., it has attained over 50

percent cover in the emergent portion of the wetland). At least 10 percent of the cattail cover will remain untreated, particularly within mucky parts of the wetland.

11. *Spray application of glyphosate* – to reduce impacts to non-target plant species, glyphosate will only be sprayed where there is a dense stand of the target plant species. Herbicide will be applied when wind speed at treatment height is ≤ 5 m.p.h. to reduce the risk of drift.
12. *Re-establishment of native herbaceous vegetation* – Large areas (*i.e.*, ≥ 1 acre or ≥ 25 percent of the wetland) that have been sprayed with glyphosate will be monitored to ensure that native herbaceous vegetation is re-establishing in the treatment area. For treatments in late summer or early fall, monitoring will take place the following spring (no later than May). For treatments in the spring, monitoring will take place one to two months following the treatment. If the treatment area is devoid of vegetation, native herbaceous vegetation or a non-invasive annual cover will be planted.
13. *Treatment documentation*
 - Areas that have been treated with herbicide will be inspected the following growing season to determine the effectiveness of the treatment method and document the re-establishment of vegetative growth (target and non-target) in the treatment area.
 - By December 31 of the year following treatment, a report will be submitted to the Service documenting the following for each target plant species treated: name of the target plant species, area (in acres) treated, treatment method and timing, herbicide and surfactant concentration used, effectiveness of the treatment (percent kill), any observed effects on non-target plants, and any observed effects on bog turtles or their use of habitat. A map showing the wetland and treated areas within the wetland will be submitted with this report. Annual performance reports submitted by state agencies to Federal Aid may be used for reporting purposes provided that they contain all of the requisite information and copies are provided to Ecological Services by Federal Aid.
 - This information will assist the Service in 1) identifying the risks, benefits and effectiveness of various habitat restoration practices; 2) tracking recovery implementation; and 3) determining if changes to this opinion are necessary to further the recovery of the bog turtle.

Effects of the Action – Although herbicide application has been conducted at several bog turtle sites using various application methods, no incidental take monitoring has occurred. Monitoring, when conducted, has been focused on inspections of the treated target plants to determine whether or not further treatment would be necessary. Therefore, the Service's effects analysis below is based on available information about herbicide and surfactant toxicity and bog turtle habitat use.

Glyphosate is water soluble, but is strongly adsorbed to soil particles, making it relatively non-mobile in the environment and unlikely to be taken up by the roots of non-target plants once it has entered the soil. It is broken down by microbial action, but due to its strong adsorption to soil, its average soil half-life is approximately two months (Tu *et al.* 2001). Glyphosate is of relatively low toxicity to birds, mammals and fish, but was not tested on reptiles or amphibians prior to EPA registration (EPA 1993).

A surfactant is often used to increase the efficacy of glyphosate. At this time, the Service's Region 5 Environmental Contaminants Program recommends the use of LI-700[®], which the Service has rated as "practically nontoxic" to aquatic organisms. Supporting documentation is provided in "*Acute Toxicity of Various Nonionic Surfactants/Spreaders Used with Glyphosate Products and Toxicity of Formulated Glyphosate Products*" prepared by Elaine Snyder-Conn, National Pest Management Coordinator for the Regional Pest Managers Meeting, Ellsworth ME August 26, 2002 and in Monheit *et al.* (2004), Solomon and Thompson (2003), and Syracuse Environmental Research Associates (1997). Despite approvals for aquatic use and extensive available data, the possibility of adverse effects (especially sub-lethal effects) cannot be completely discounted.

A recent laboratory study conducted by Donald Sparling of Southern Illinois University suggests that exposing red-eared slider (*Trachemys scripta elegans*) embryos to treatment solutions containing a glyphosate + surfactant mixture may affect post-hatching survival. Sparling investigated the effects of direct exposure of embryos to herbicide mixtures by dipping turtle eggs into solutions containing different concentrations of Glypro[®] (0, 1.2, 3.5, 10.6, 31.7, or 95%) and a set concentration (3%) of the surfactant LI-700[®]. Effects were then quantified by measuring the time taken by individual hatchlings to right themselves after being turned over. Hatchlings exposed to the mixture containing 95% Glypro[®] were "less capable of righting themselves and showed less progress in gaining strength and agility post hatch than those at other treatments" (Sparling 2005). Additionally, hatchlings exposed to Glypro[®] at lower concentrations showed "subtle differences in behavior... compared to controls in that there were substantially fewer animals that righted themselves within 30 seconds." Results also suggest that the surfactant LI-700 may have a genotoxicity effect (Sparling 2005).

Glyphosate application is an effective means of controlling invasive plant species that degrade bog turtle habitat – and in situations where it is not possible to use grazers to control invasive species, herbicide application may be the only effective means of control. Surfactants increase the efficacy of glyphosate; greater habitat improvement is realized more quickly and the need for repeat treatment is minimized. For example, a glyphosate/LI-700[®] mixture was used to treat large quantities of multiflora rose adjacent to five bog turtle wetlands in Maryland during the summers of 2002 and 2003. Based on transect surveys, mortality of multiflora rose during the growing season following treatment was nearly 100 percent (Schultz 2004). Due to its thorny arching stems, it is very difficult to control multiflora rose using hand-held equipment. In addition, removal of multiflora rose by other methods, including cutting or pulling by tracked or wheeled vehicles could result in a higher risk of habitat damage and incidental take than herbicide application, especially if the rose occurs in mucky areas.

Spray application of glyphosate poses a threat to non-target plant species due to chemical drift. If applicators are not careful, herbicide drift could kill native herbaceous vegetation used by bog turtles for nesting, basking, foraging and cover, potentially resulting in harm.

Careful adherence to the label directions when using these herbicides, and full implementation of the conservation measures will substantially reduce the potential for adverse sub-lethal effects on bog turtles by reducing the risk of exposure to glyphosate and LI-700®.

With all of the herbicide treatment methods, there is a risk of trampling bog turtle nests – particularly when the treatment is carried out in the emergent part of the wetland by a large crew of applicators in mid-May to mid-September. In addition, there is a risk of spilling herbicide into wetland soils and onto bog turtle nests, directly or indirectly exposing bog turtles and turtle embryos to herbicide. These risks have been reduced by avoiding any herbicide application in *known* nesting areas during the nesting season and by limiting the amount of the wetland that can be treated at one time. However, in most cases, nesting areas will not be known prior to treatment.

There is also a risk of exposing brumating turtles to herbicide, especially when concentrated herbicide is delivered to the stems of woody or herbaceous plants in late summer, fall or winter. Although woody vegetation within known hibernating areas will not be treated (see conservation measures), in most cases the locations of hibernacula will not be known prior to treatment. If herbicide leaches from the roots into the soil, turtles could be exposed to herbicide if they brumate among the root systems of treated plants. During this period, herbicide breakdown will be slow due to cold temperatures and turtles will remain among the roots for a prolonged period of time. However, exposure is likely to be limited due to the tendency of glyphosate to bind to soil.

Although the purpose of herbicide treatment is to elicit beneficial changes in the wetland's vegetative cover types, the treatment may result in short-term adverse effects to bog turtles, particularly if key areas (*e.g.*, hibernacula) or large areas of the wetland are treated at one time. Although the woody vegetation associated with *known* hibernating areas will not be treated, in most cases the location of hibernacula will not be known. Changes to a hibernating area may make that area less desirable or potentially less suitable, prompting turtles to seek another area for hibernation. In addition, spray application of glyphosate in a large treatment area may leave that area devoid of vegetation for a period of time. Until the area re-vegetates, turtles must either seek food and shelter in an untreated area of the wetland, or risk staying in the treatment area. Turtles that stay in the treatment area may face an increased risk of predation, decreased food supply, and less than optimal conditions for regulating body temperature. In most cases, the on-site seed bank and vegetative community will probably be sufficient to ensure that treated areas re-vegetate rapidly. However, there may be situations in which the treatment area is devoid of vegetation for many months, or re-vegetates with invasive plants. The conservation measures seek to minimize these risks by limiting the treatment area to no more than 50 percent of the wetland, by limiting the spray application method to dense stands of invasive plants, and by providing for the replanting of herbaceous vegetation.

Conclusion – In light of the benefits of habitat restoration and the low risk of adverse effects on bog turtles, the Service concludes that use of glyphosate – either alone or in conjunction with LI-700® – is not likely to jeopardize the continued existence of the bog turtle. No critical habitat has been designated for the bog turtle; therefore none will be affected.

Incidental Take Statement – There is some available information indicating that glyphosate and LI-700® may adversely affect bog turtles. This includes a study (Sparling 2005) indicating that direct exposure of eggs may cause adverse effects. However, the risk of incidental take due to herbicide or surfactant exposure is very small because 1) most treatment methods result in delivery of herbicide directly to the target plant, resulting in little risk of bog turtle or nest exposure; 2) implementation of the conservation measures will substantially reduce the risk of embryo exposure; 3) exposure of adults will be minimal because they are not likely to occur in high densities in the areas to be treated (*i.e.*, forested areas, thick shrubby vegetation, or thick monotypic stands of invasive herbaceous vegetation); and 4) when used according to label directions, glyphosate and LI-700® appear to have a low risk of toxicity effects.

While the Service acknowledges there may be some risk of take due to the direct or indirect effects of the herbicide and/or surfactant, the risk is likely to be very small and any take resulting from such effects is currently unquantifiable. While no death, injury or reproductive impairment is currently anticipated due to herbicide or surfactant exposure, any observations indicating that glyphosate, imazapyr or LI-700® may have caused take of bog turtles or impaired their reproductive success must be promptly reported to the USFWS Office of Law Enforcement and the Ecological Services Endangered Species branch.

There is also a risk of incidental take due to the human activity associated with herbicide application, and due to short- and long-term changes in the wetland. Although implementation of the conservation measures will reduce these risks, we anticipate that bog turtle nests will be damaged or destroyed, or bog turtles will be harassed or harmed in the following situations: 1) when a large crew carries out herbicide application throughout a significant portion of the wetland, 2) when unknown hibernating areas are treated, 3) when unknown nesting are treated, and 4) when large areas of the emergent part of the wetland are treated and fail to quickly re-vegetate.

3. Cutting and Removal of Woody Vegetation

Project Description – To control woody vegetation in wetlands, project proponents will use either use hand-held equipment (*e.g.*, chainsaw, ax, saw) and enter the wetland on foot, or use heavy equipment such as a skid steer with a rotary cutter or tree shear attachment. In some cases, both types of equipment may be used. The rotary cutter can cut woody vegetation up to three inches in diameter, while the tree shear can cut trees up to 16 inches d.b.h.

The extent of woody vegetation control will vary based on site conditions. At some sites, woody vegetation is just beginning to encroach into the wetland, so the control of this vegetation will only affect a small portion of the wetland and control could be done with light equipment (*e.g.*, chainsaw). In other cases, woody vegetation has overtaken the wetland, resulting in almost full

canopy closure. Control measures at those sites may affect the entire wetland over a period of a few years.

This opinion contemplates the cutting and removal of woody vegetation using heavy equipment, and the cutting and removal of woody vegetation greater than three inches d.b.h. using either light or heavy equipment (see *Glossary*) between November 1 and March 31, when bog turtles are likely to be hibernating. Also covered in this section of this biological opinion is cutting and removal of woody vegetation <3" d.b.h. using light equipment between April 1 and September 30. The Service has determined that the cutting and removal of woody vegetation <3" d.b.h. using light equipment between October 1 and March 31 is not likely to adversely affect bog turtles (see *Practices Not Likely to Adversely Affect Bog Turtles*).

Conservation Measures – To minimize the risk of take, the following conservation measures will be implemented in wetlands occupied by bog turtles.

1. *Project description and map* – After the site has been field-viewed by a monitoring biologist (see *Glossary*), a detailed project description, project location map, and site map will be prepared. The project location map will identify the project's location on a USGS topographic map. The site map will identify the property boundaries, wetland boundaries, *known* nesting and hibernating areas, "mucky areas" (regardless of vegetative cover type), and proposed treatment areas. The project narrative will include detailed information about the proposed treatment, including timing and duration of treatment, treatment method(s) (e.g., type of equipment to be used), and size of area to be treated. This information will be submitted to the Fish and Wildlife Service (e.g., Private Stewardship Grants) or appropriate state wildlife agency (e.g., State Wildlife Grants, Landowner Incentive Program Grants) for review and approval. In the case of projects implemented by the Partners for Fish and Wildlife Program, this information will be retained in their project files.
2. *Role of monitoring biologist* (see *Glossary*)
 - A monitoring biologist will field-view the site and work with the project proponent to determine which restoration activities are necessary and appropriate.
 - When possible, telemetry or early season surveys will be conducted to identify particular patches of woody vegetation serving as hibernacula. Such areas will not be subject to woody vegetation control. If possible, surveys will also be conducted to identify nesting areas.
 - Prior to carrying out woody vegetation control, a monitoring biologist will walk through the wetland to identify and clearly mark and map "mucky areas" (see *Glossary*). In addition, the monitoring biologist will identify and clearly mark and map any known nesting and hibernating areas, as well as the areas of woody vegetation to be retained. The markings used to identify nesting and hibernating areas will be removed when the project is completed.

- The monitoring biologist will help to identify the most appropriate travel routes (see *Glossary*) for heavy equipment within the wetland. These travel routes will avoid mucky areas, known nesting and hibernating areas, and areas of woody vegetation to be retained.
 - A pre-project implementation meeting will occur the day before or morning of the work, during which direct lines of authority will be established and the project will be discussed in detail. A carefully planned command hierarchy needs to be established and communicated clearly to all involved, particularly if operators and others are being drawn from different offices and/or agencies. The hierarchy should be based first and foremost on knowledge of bog turtle habitat and avoidance of take.
 - A monitoring biologist will be present on site the first day restoration activities are undertaken to brief workers on the conservation measures, and ensure that sensitive areas (*e.g.*, nesting areas, hibernating areas, mucky areas) and areas of woody vegetation to be retained are clearly marked and avoided.
 - When the project entails cutting and removal of woody vegetation less than three inches d.b.h. using light equipment between April 1 and September 30, pre-project orientation by the monitoring biologist will include the need for workers to avoid walking on hummocks and identification of routes to avoid when dragging woody debris. The monitoring biologist will conduct periodic inspections on a frequency appropriate to habitat conditions, likely bog turtle activity, experience of the crew, and project scope and duration.
 - In addition to the operator, each piece of heavy equipment (see *Glossary*) will have an assigned biologist familiar with bog turtle habitat. This attendant will precede the equipment into work areas. An appropriate signaling system should be adopted or 2-way radio headphones should be used to establish communication links between operators and biologist attendants. The attendant will stay with the equipment the entire time it is in use in the wetland to ensure equipment does not enter restricted areas (*i.e.*, known nesting and hibernating areas, mucky areas, areas of woody vegetation to be retained). The biologist attendant's decisions on entering/not entering areas must supercede the operator's opinions, regardless of rank or agency affiliation.
 - If heavy equipment enters mucky areas or known nesting or hibernating habitat, the monitoring biologist will survey these areas for signs of adverse effects, including dead or injured bog turtles, and damage to habitat.
3. *Treatment area* – No more than 50 percent of the wetland will be subject to woody vegetation cutting and removal in any one year period. Refer also to treatment area limitations under Implementation of Multiple Restoration Practices, page 28 of this document.

4. *Retention of woody vegetation* – Approximately 10-20 percent of the native tree and shrub cover in “mucky areas” (see *Glossary*) in both the emergent and forested parts of the wetland will be retained (*i.e.*, not treated), especially alder, red maple and poison sumac located in or near seeps, springs, rivulets and mucky areas. These areas will be clearly marked or flagged to avoid treatment.
5. *Spill avoidance* – To reduce the risk of spills within the wetland, vehicles and heavy machinery will be serviced in upland areas. When it is necessary to fuel light equipment (chainsaws, hand-held power augers, etc.) in the wetland, absorbent pads will be used to catch and contain any spills.
6. *Seasonal restriction* – Use of heavy equipment and treatment of material >3” d.b.h. will be conducted between November 1 and March 31.
7. *Felling woody vegetation* – Whenever possible, woody vegetation ≥ 4 inches d.b.h. will be felled into adjacent uplands or into non-mucky areas of the wetland.
8. *Mucky area restrictions*
 - Mucky areas of the wetland (see *Glossary*) will only be entered on foot. Any felling of woody vegetation will be done using light equipment (*e.g.*, chainsaw, ax). Heavy equipment (see *Glossary*) will not be driven through, or used to cut or remove woody vegetation from mucky areas.
 - In mucky areas of the wetland, woody vegetation may also be controlled using the injection, hack-and-squirt or cut stump methods. If cut, stumps will be treated with glyphosate before November 30 to prevent re-growth, or grazers will be introduced to control the re-growth. If stems are cut too late to apply herbicide, enough of the stump may be retained to make a second cut in the spring in order to do a cut stump application of glyphosate then.
 - Woody vegetation ≥ 4 inches d.b.h. will not be dragged through mucky areas of the wetland, unless there is sufficient frozen ground or snow/ice cover to prevent disturbance to wetland soils. Rather, the vegetation will be left in place, or cut into pieces small enough to remove by hand and then processed or placed in an upland area. If the monitoring biologist determines that large-diameter woody debris would result in adverse hydrological changes to the wetland (*e.g.*, by blocking water flow), or would be so abundant that it would impede bog turtle movement, the woody debris will be removed to avoid or minimize this effect.
 - To avoid displacement of hibernating turtles and potential destruction of hibernacula, woody vegetation will not be pulled out by its roots in mucky areas.

9. *Use of Heavy Equipment*

- Heavy equipment (see *Glossary*) will not be used in or driven through:
 - known nesting areas
 - known hibernating areas
 - mucky areas – except when it is necessary to cross a narrow, mucky channel or rivulet to reach non-mucky parts of the wetland. When this is necessary, mats or temporary bridges (*e.g.*, of logs placed across the channel) will be used to support the equipment.
- Heavy equipment will only be used in the wetland when: 1) day and nighttime temperatures are at or below freezing for a minimum of one week prior to conducting work, or 2) wetland surfaces are frozen such that ice supports the weight of an adult human (except perhaps at spring heads and other deep muck areas where heavy equipment will not be allowed). If during the course of the work a warm period occurs with general thawing, then restoration work will be limited to chainsaws (*i.e.*, no heavy equipment in use within wetland boundaries).

10. *Treatment documentation*

- Areas that have been treated will be inspected the following growing season to determine the effectiveness of the treatment method.
- By December 31 of the year following treatment, a report will be submitted to the Service documenting the following for each target plant species treated: name(s) of the target plant species, area (in acres) treated, treatment method, effectiveness of the treatment, any observed effects on non-target plants, any observed effects on wetland soils or hydrology (*e.g.*, rutting, channelization), and any observed effects on bog turtles or their use of habitat. A map showing the wetland and treated areas within the wetland will be submitted with this report. Annual performance reports submitted by state agencies to Federal Aid may be used for reporting purposes provided that they contain all of the requisite information and copies are provided to Ecological Services by Federal Aid.
- This information will assist the Service in 1) identifying the risks, benefits and effectiveness of various habitat restoration practices; 2) tracking recovery implementation; and 3) determining if changes to this opinion are necessary to further the recovery of the bog turtle.

Effects – Bog turtles are long-lived and may persist for many years at sites that have reverted to wooded swamps. Unfortunately, their ability to successfully nest in such habitat is compromised, and the populations at such sites will eventually perish if recruitment does not occur. Mechanical removal of woody vegetation will open up areas of the wetland to increased solar exposure, allowing native herbaceous vegetation to become re-established. This will increase the amount of emergent habitat available for successful bog turtle nesting and basking.

The use of heavy equipment in wetlands occupied by bog turtles poses a direct risk of injury or death to turtles. For example, one bog turtle was killed during habitat restoration activities at a site in Maryland, and it is possible that others were killed or injured, but not located. Heavy equipment was used in the subject wetland to remove multiflora rose and install fencing. During a follow-up survey, one crushed bog turtle was found in a tire track near a spring area that was probably used for hibernation (Constantino 2005, Smith 2005). The muck in this area was three to five inches deep and underlain by rock. The documented mortality occurred because equipment operators entered flagged (restricted areas). In this and other situations where heavy equipment has been used, it has become apparent that it is almost impossible for equipment operators to look for sensitive habitats in the wetland while also operating the heavy equipment (Constantino 2006, Smith 2005). We are not aware of incidental take monitoring occurring at other sites where restoration activities have been carried out.

The conservation measures listed above will substantially reduce the risk of take. When it is necessary to cut large woody vegetation or use heavy equipment in wetlands, it will be done between November 1 and March 31, when bog turtles are hibernating or concentrated near their hibernation areas. Although the locations of these hibernacula will not usually be known prior to project implementation, the risk of take will be minimized by restricting vehicle use in areas of the wetland that are potentially suitable for hibernation (*i.e.*, mucky areas). If vehicles were used in mucky areas of the wetland, it is likely that take would be substantially higher due to the need for multiple passes through these areas to position and re-position the vehicle to cut and remove trees. In mucky areas of the wetland, the control of woody vegetation via herbicide injection into the trunks of trees (*e.g.*, via an E-Z-Ject[®] Lance) would avoid the potential direct effects that may occur when mechanical control measures are used.

Despite implementation of these conservation measures, there remains some risk of take. In situations where it is necessary to cut trees in mucky areas, it is possible that a tree will fall on a hibernaculum – killing, injuring, or displacing one or more turtles. If a hibernating turtle is displaced from its hibernaculum due to the felling of a tree or vehicle use in mucky areas, the turtle may avoid immediate death/injury but have to reposition itself in an appropriate hibernating location. If it has been forced to the surface, a combination of cold temperatures and slow body metabolism may prevent it from successfully locating an appropriate hibernating spot, leading to death.

It is likely that some mucky areas will not be identified during site reconnaissance and that heavy equipment will occasionally be driven through mucky areas during restoration activities. If tracked or wheeled vehicles are driven through mucky areas – accidentally, intentionally or because the mucky areas were not carefully delineated prior to project implementation – hibernating turtles could be crushed (killed), injured, or displaced from their hibernacula placing them at an increased risk of death.

Cutting and removal of material <3" d.b.h. between April 1 and September 30 also poses a risk of disturbance to mating turtles and disturbance, injury, or death of nests and hatchlings. Guidance from the monitoring biologist and avoidance of hummocks will substantially reduce, but will not completely remove, this risk.

It is also possible that indirect effects may result, particularly if a large number of trees are felled in the wetland and left in place. These trees may impede bog turtle movement in the wetland, resulting in harm or harassment. Use of an experienced monitoring biologist to assess and minimize this risk, and use of herbicide application in mucky areas for woody vegetation control will reduce the risk of indirect effects.

Indirect effects may also result from changes to hibernating areas. Although the woody vegetation associated with *known* hibernating areas will not be treated, in most cases the location of hibernacula will not be known. Changes to a hibernating area may make that area less desirable or potentially less suitable, prompting turtles to seek another area for hibernation. Although implementation of the conservation measures will reduce these risks, bog turtles may be harassed or harmed when a large part of the wetland is subject to woody vegetation control or when undocumented hibernating areas are treated.

Conclusion – In light of the benefits of habitat restoration and the implementation of conservation measures to minimize potential adverse effects, the Service concludes that the cutting and removal of woody vegetation is not likely to jeopardize the continued existence of the bog turtle. No critical habitat has been designated for the bog turtle; therefore none will be affected.

Incidental Take Statement – The Service estimates that up to two bog turtles may be killed or injured per site at sites subject to the most extensive mechanical control of woody vegetation within mucky areas (*i.e.*, control within ≥ 25 percent of the mucky area within the wetland), but the extent of injury is likely to average less than one turtle killed or injured at most sites. At sites subject to less extensive control of woody vegetation between November 1 and March 31, up to one bog turtle will be killed or injured for every ten sites treated. Cutting and removal of vegetation using light equipment between April 1 and September 30 may result in killing up to one bog turtle and loss of up to two nests for every ten sites treated.

4. Implementation of Multiple Restoration Practices

Project Description – At some sites, it may be necessary to implement multiple practices over a period of one to a few years to control invasive plants and restore bog turtle habitat. For example, prior to the introduction of grazing, it may be necessary to cut woody vegetation, treat woody vegetation with herbicide, and/or install fencing. Where grazing is not possible, it may be necessary to control woody and herbaceous vegetation via cutting and glove application of glyphosate, respectively.

Because sites often suffer from the effects of multiple invasive plant species, restoration plans will be designed by someone familiar with bog turtles, their habitat requirements, and the restoration practices described in this opinion.

Conservation Measures – To minimize the risk of take, the following conservation measures will be implemented in wetlands occupied by bog turtles when multiple restoration practices are proposed.

1. *Practice-specific conservation measures* – All practice-specific conservation measures will be implemented.
2. *Total treatment area* – No more than 50 percent of the wetland will be subject to all combined habitat restoration practices in any one year period. This limit on overall treatment area does not apply to the installation of fencing to facilitate grazing or to the practices not likely to adversely affect bog turtles, as described above in this document.

CUMULATIVE EFFECTS

At 50 CFR 402.02, “cumulative effects” are defined as those effects of future State or private activities, not including federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act. No cumulative effects are foreseen or have been evaluated for the proposed action.

In some cases, the action area for these projects may be subject to future State and private activities that are reasonably certain to occur (*i.e.*, cumulative effects), such as nearby upland developments. However, the activities contemplated in this document are not anticipated to cause adverse effects that are synergistic with cumulative effects. The Service has determined, therefore, that for the purposes of completing the jeopardy analysis and conclusion, activities in this document can be effectively analyzed independent of future State and private activities.

SUMMARY CONCLUSION

After reviewing the current status of the bog turtle, the environmental baseline for the action area, and the effects of the types of restoration activities proposed, it is the Service’s biological opinion that implementation of the described habitat restoration activities is not likely to jeopardize the continued existence of the northern population of the bog turtle. No critical habitat has been designated for this species; therefore, none will be affected.

The Service has based this determination on the relatively few bog turtles that are likely to be killed or injured during the implementation of habitat restoration activities. The loss of a small number of turtles will be more than offset by the beneficial effects of habitat restoration. Habitat restoration and maintenance projects are expected to restore degraded bog turtle habitat or maintain that habitat in a condition appropriate for the turtle. These activities will increase the amount of high quality emergent vegetation necessary for bog turtle nesting, basking, and escape cover. The restoration of nesting habitat is likely to improve nesting success, leading to a gradual increase in the population at a site, provided other factors (*e.g.*, predation, poaching, road kills) do not offset these increases in reproductive output. Although beneficial effects, such as increased reproductive success are expected, at this time the beneficial effect cannot be quantified.

If implemented at numerous sites within the northern range, the proposed restoration practices may help reverse (or at least slow) the decline of the northern population of the bog turtle and increase the likelihood of recovery from its threatened status. Provided there is full implementation of the practice-specific conservation measures, the proposed actions are not likely to appreciably reduce the likelihood of the survival or recovery of the northern population of the bog turtle. In fact, based on a review of the current status of the species, the Service concludes that the proposed restoration practices are likely to result in net beneficial effects at both the site and population level.

INCIDENTAL TAKE STATEMENT

Section 9 of the Endangered Species Act, as amended, and federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering.

In accordance with the regulations governing section 7 consultation (50 CFR part 402), the Service is charged with issuing a biological opinion indicating whether or not the proposed action is likely to jeopardize the continued existence of listed species. In those cases where the Service concludes that an action (or the implementation of any reasonable and prudent alternatives) and the resultant incidental take of listed species will not violate section 7(a)(2) of the Act, the Service provides an "incidental take statement" with the biological opinion. The incidental take statement exempts the take anticipated as a result of the action.

Because incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity, this Incidental Take Statement is valid only upon receipt of appropriate authorizations and permits from federal, State and local permitting authorities. This may include permits or authorizations for herbicide application, tree removal or fence installation in wetlands. Permitting requirements vary by State and local governing authority; therefore, project proponents should determine what authorizations may be needed before beginning work.

Under the terms of section 7(b)(4) and section 7(o)(2) of the Endangered Species Act, taking that is incidental to and not intended as part of the agency action is not considered to be a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Service so that they become binding conditions of any restoration project implemented or funded for the exemption in section 7(o)(2) to apply. The Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Service 1) fails to assume and implement the

terms and conditions, or 2) fails to require the grant recipient to adhere to the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Service or grant recipient must report the progress of the action and its impacts on the species as specified in the incidental take statement [50 CFR 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

Incidental take of bog turtles is expected to be in the form of killing, injuring, harming or harassing during habitat restoration activities. The actual level of incidental take will be difficult to detect or quantify for the following reasons: 1) individuals of this species are small; 2) bog turtles are likely to exhibit predator-evasive behaviors (*e.g.*, burying themselves in the substrate during restoration activities) making them difficult to locate; and 3) finding dead or injured specimens is unlikely due to the nature of activities proposed.

Based on the practice-specific effects analyses, the Service anticipates that incidental take will not exceed the following:

- Death or injury of up to one bog turtle for every ten sites fenced where heavy equipment (*i.e.*, tracked or wheeled vehicles) is used in the wetland.
- Loss of one or more bog turtle nests, and harm or harassment of one or more bog turtles during herbicide application in the following situations: 1) when a large crew carries out herbicide application throughout a significant portion of a wetland, 2) when unknown hibernating areas are treated, 3) when unknown nesting areas are treated, and 4) when large areas of the emergent part of the wetland are treated and fail to quickly re-vegetate.
- Death or injury of up to two bog turtles per site at sites subject to the most extensive control of large woody vegetation within mucky areas (*i.e.*, control within ≥ 25 percent of the mucky area within the wetland), particularly when using heavy equipment. At sites subject to less extensive control of woody vegetation, death or injury of up to one bog turtle for every ten sites subject to woody vegetation control efforts between November 1 and March 31. Death of up to one bog turtle and loss of up to two nests for every ten sites where material <3 " d.b.h. is cut and removed between April 1 and September 30.

When multiple restoration practices are proposed at a site, the Service does not expect an increase in take over the practice-specific take estimates because the total treatment area will be limited, and most of the practices present a fairly low risk of take when the conservation measures are implemented.

The Service estimates that the Partners for Fish and Wildlife Program and Federal Aid Program will implement or fund habitat restoration practices at 20 to 40 occupied bog turtle sites per year within the northern range of the species. Based on the practice-specific effects analyses, and assuming the three practices are implemented proportionately, the Service estimates that habitat restoration activities over this period of time will result in the death or injury of three bog turtles per year. At many sites, short term harassment of bog turtles may also occur while the

restoration activities are being undertaken. Over the 5-year period covered by this opinion (*i.e.*, 2006 - 2010), habitat restoration practices may occur at 100 to 200 bog turtle sites resulting in the death or injury of up to 15 bog turtles.

This level of incidental take is not expected to result in adverse population-level effects at either individual sites or within the northern range of the species. The Service anticipates that the beneficial effects of habitat restoration will substantially exceed the adverse effects.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of expected take is not likely to result in jeopardy to the bog turtle.

REASONABLE AND PRUDENT MEASURES

Many measures to reduce take have been incorporated into the descriptions of the practices reviewed in this document. These measures are integral to the analysis of effects and resulting determinations. Implementing programs are responsible for assuring consistency of all projects conducted under the auspices of this biological opinion with these conservation measures. The only reasonable and prudent measure for these projects, therefore, is monitoring and reporting of take in accordance with the terms and conditions specified below.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Endangered Species Act, the Service (*e.g.*, Partners for Fish and Wildlife Program) or the applicant (*e.g.*, State wildlife agency) must monitor and report take in accordance with the following non-discretionary terms and conditions:

1. Upon finding a dead or injured turtle that has been, or is likely to have been, killed or injured by habitat restoration practices at a site, the action agency or project proponent will immediately contact the Service. If the turtle was likely killed or injured by the use of heavy equipment (*e.g.*, tracked or wheeled vehicles), use of the vehicles will be discontinued until a site investigation by a Service endangered species biologist takes place. The conditions leading to the death or injury of the turtle(s) will be documented to assist the Service in designing future projects and to ensure that the assumptions and effects detailed in this opinion are correct.
2. Care must be taken in handling dead or injured bog turtles that are found in the project area to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the Endangered Species Act. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the

conservation measures and terms and conditions are appropriate and effective. Upon locating a dead, injured, or sick bog turtle, notification must be made within 24 hours to:

- U.S. Fish and Wildlife Service – Office of Law Enforcement, 300 Westgate Center Drive, Hadley, Massachusetts 01035-9589 (telephone: 413-253-8343); and
- The lead endangered species biologist in the Ecological Services Field Office within the State where the restoration project took place.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. To the maximum extent practicable, engage Service endangered species staff in collaborative review of site-specific restoration plans prior to project implementation.
2. Where opportunities exist, work with landowners, the general public, and other agencies to promote education and information about the bog turtle and its conservation. Assist in the purchase and protection of wetlands occupied by bog turtles.
3. To determine the effect of restoration activities on bog turtles, conduct pre- and post-restoration telemetry studies to document habitat areas used for nesting, hibernating, and foraging. In addition, determine nesting success pre- and post-restoration.
4. Pursue opportunities for funding studies to further investigate the effects of glyphosate and other herbicides (of presumably low toxicity) on reptiles.
5. Determine the effectiveness of controlling reed canary grass via spray applications of glyphosate in wetlands that are *not* occupied by bog turtles. Of particular interest is determining the level and duration of control, and conducting follow-up monitoring to determine what plant species colonize after treatment. If native plant species do not readily re-colonize former reed canary-dominated stands, determine what level of seeding or replanting is necessary to re-establish desirable herbaceous vegetation.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the request. As provided in 50 C.F.R. §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the actions has been retained (or is authorized by law) and if: 1) The amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the action is subsequently modified in a manner that causes an

effect to the listed species or critical habitat not considered in this opinion. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.



Assistant Regional Director

3/10/06

Date

LITERATURE CITED

- Arndt, R. G. 1977. Notes on the natural history of the bog turtle, *Clemmys muhlenbergii*, (Schoepff), in Delaware. *Chesapeake Science* 18(1): 67-76.
- Barton, A.J., and J.W. Price. 1955. Our knowledge of the bog turtle, *Clemmys muhlenbergii*, surveyed and augmented. *Copeia* 1955(3):159
- Chase, J.D., K.R. Dixon, J.E. Gates, D. Jacobs, and G. Taylor. 1989. Habitat characteristics, population size, and home range of the bog turtle, *Clemmys muhlenbergii*, in Maryland. *J. Herpetol.* 23(4):356-362.
- Collins, D.E. 1990. Western New York bog turtles: Relicts of ephemeral islands or simply elusive? *Ecosystem management: Rare species and significant habitats*. New York State Museum Bulletin 471:151-153.
- Constantino, Maricela. 2005. U.S. Fish and Wildlife Service, Chesapeake Bay Field Office. In litt.
- Constantino, Maricela. 2006. U.S. Fish and Wildlife Service, Chesapeake Bay Field Office. In litt.
- Environmental Protection Agency. 1993. Reregistration Eligibility Decision: Glyphosate. EAP-738-F-93-011, September 1993, Environmental Protection Agency, Washington, DC. http://www.epa.gov/oppsrrd1/REDS/old_reds/glyphosate.pdf
- Ernst, C.H. 1977. Biological notes on the bog turtle, *Clemmys muhlenbergii*. *Herpetologica* 33(2):241-246.
- Ernst, C.H., R.T. Zappalorti, and J.E. Lovich. 1989. Overwintering sites and thermal relations of hibernating bog turtles, *Clemmys muhlenbergii*. *Copeia* 1989(3):761-764.
- Herman, Dennis. 2005. North Carolina Department of Transportation. In litt.
- Herman, D.W. 1990. Captive husbandry of the eastern *Clemmys* group at Zoo Atlanta. First International Symposium on Turtles & Tortoises: Conservation and Captive Husbandry 1990: 54-62.
- Herman, D.W., and G.A. George. 1986. Research, husbandry, and propagation of the bog turtle *Clemmys muhlenbergii* (Schoepff) at the Atlanta Zoo, pages 125-135 in Sean McKeown *et al.*, eds., *Proceedings of the 9th International Herpetological Symposium on Captive Propagation and Husbandry*. Zoological Consortium, Inc., Thurmont, MD.
- Hillmer, J. & D. Liedtke. 2003. Safe herbicide handling: a guide for land stewards and volunteer stewards. Ohio Chapter, The Nature Conservancy, Dublin, OH. 20 pp.

- Monheit, S, J.R. Leavitt and J. Trumbo. 2004. The ecotoxicology of surfactants used with glyphosate based herbicides. *Noxious Times*, Volume 6, No. 2, Summer 2004.
- Nemuras, K.T. 1967. Notes on the natural history of *Clemmys muhlenbergii*. *Bulletin of the Maryland Herpetological Society* 3:80-96.
- Schultz, B. 2004. Maryland Bog Turtle (*Clemmys muhlenbergii*) Report and the Condition of Vegetation at 22 Wetlands. Unpublished USFWS report, Annapolis, Maryland.
- Smith, Scott. 2005. Maryland Department of Natural Resources, Wildlife and Heritage Services. In litt.
- Solomon, K.R., and D.G. Thompson. 2003. Ecological risk assessment for aquatic organisms from over-water uses of glyphosate. *Journal of Toxicology and Environmental Health* 6:289-324.
- Somers, A.B., K.A. Bridle, D.W. Herman, and A.B. Nelson. 2000. The Restoration and Management of Small Wetlands of the Mountains & Piedmont in the Southeast: A Manual Emphasizing Endangered & Threatened Species Habitat with a Focus on Bog Turtles. Joint publication of the Watershed Science & Wetland Science Institutes of the Natural Resources Conservation Service, The University of North Carolina at Greensboro, and Pilot View Resource Conservation & Development, Inc. 152 pp.
- Sparling, D.W. 2005. Effects of Glyphosate of Turtle Embryos. Report prepared for the U.S. Fish and Wildlife Service through a cooperative agreement with The Nature Conservancy. 20 pp.
- Syracuse Environmental Research Associates, Inc. 1997. Effects of surfactants on the toxicity of glyphosate, with specific reference to Rodeo. USDA Contract No. 53-3187-5-12, Order No. 43-3187-7-0028. SERA TR 97-206-1b.
- Tesauro, J. 2001. Restoring wetland habitats with cows and other livestock. *Conservation Biology in Practice* 2:26-30.
- Tryon, B.W. 1990. Bog turtles (*Clemmys muhlenbergii*) in the South--a question of survival. *Bulletin of the Chicago Herpetological Society* 25(4):57-66.
- Tu, M., Hurd, C. and J.M. Randall. 2001. Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas (version: April 2001). The Nature Conservancy, <http://tncweeds.ucdavis.edu>.
- U.S. Fish and Wildlife Service. 1997. Final rule to list the northern population of the bog turtle as threatened and the southern population as threatened due to similarity of appearance. *Federal Register*, Vol. 62, No. 213, pp. 59605-59623.

U.S. Fish and Wildlife Service. 2001. Bog Turtle (*Clemmys muhlenbergii*), Northern Population, Recovery Plan. Hadley, Massachusetts. 103 pp.

Zarate, B.R. 2005. Zoologist. New Jersey Division of Fish and Wildlife, Endangered and Nongame Species Program, Trenton, New Jersey. (personal communication)

Appendix A – GLOSSARY OF TERMS

Glove application – application of glyphosate to a plant using a cotton glove saturated with the herbicide. The herbicider wears chemical resistant nitrile or latex gloves on both hands covered by a fleecy, cotton glove on one of the hands. The target plant is held by the hand with the cotton glove and herbicide is sprayed into that hand (trying not to hit non-target plants). Then the cotton glove is wicked up the top one-third of the plant.

Heavy equipment – tracked or wheeled vehicles

Large grazers – cattle, horses and other similar-sized animals

Light equipment – equipment that is hand carried (e.g., chainsaw, hatchet or E-Z-Ject[®] Lance)

Light to moderate grazing – Also referred to as “habitat maintenance grazing” or “maintenance grazing”. This type of grazing is done to maintain bog turtle habitat in a primarily emergent vegetative condition, with minimal presence of invasive herbaceous plants. A stocking density of up to 0.75 animal units per acre of “grassland” is used within the fenced enclosure.

“Grassland” is defined as open, grassy areas such as areas with emergent wetland vegetation (e.g., sedges, rushes); upland pasture grasses (e.g., fescue, timothy); or invasive, exotic plants (e.g., *Phragmites*, reed canary grass). This stocking density is equivalent to one dairy cow per two acres, four mature sheep per acre, or five mature goats per acre of grassland within the fenced enclosure. See Appendix B for an animal unit equivalents guide. Grazers have access to both upland and wetland areas, and large grazers are excluded from known nesting areas during the bog turtle nesting season (June 1 to September 30).

Maintenance grazing – see “light to moderate grazing”

Monitoring biologist – a biologist familiar with bog turtle life history and habitat requirements. This person is a Service endangered species biologist, a State non-game biologist, a recognized qualified bog turtle surveyor, or other approved biologist skilled in the identification of potential bog turtle habitat, as well as the identification of known and potentially suitable nesting and hibernating areas within wetlands occupied by bog turtles. The qualifications of potential monitoring biologists will be reviewed and approved at the Field Office level by an endangered species biologist.

Mucky areas – areas of the wetland having soft, saturated substrates at least four inches deep. These areas are usually identified using a wooden probe (e.g., broom or tool handle).

Non-mucky areas – areas of the wetland lacking soft, saturated substrates or having soft, saturated substrates that can only be probed to a depth of less than four inches.

Small grazers – sheep and goats

Travel route – a path used repeatedly by heavy equipment to access the project site.

Wetland – refers to the entire wetland, not just the best bog turtle habitat within the wetland

Wetlands occupied by bog turtles – any wetland where bog turtles have been confirmed at any time within the past 50 years.

Appendix B – ANIMAL UNIT EQUIVALENTS¹

Kind of livestock	Animal-unit equivalent²
Cow, young dairy (heifer, 1-2 yrs)	1.0
Cow, mature dairy (3+ yrs)	1.5
Bull, mature	1.5-1.9
Cattle, mature beef (1-2 yrs)	1.0
Horse, mature draught	2.0
Horse, mature saddle	1.25
Sheep, mature	0.20
Lamb, 1 year old	0.15
Goat, mature	0.17
Kid, 1 year old	0.10

¹ Table compiled from various sources, including: Maryland Department of Agriculture, 1999 (http://www.mda.state.md.us/resource_conservation/nutrient_management/manual/animal_unit_equivalencies.php); Delaware Department of Agriculture, 2000 (http://www.state.de.us/deptagri/nutrients/newsltr/feb_00.shtml); USDA, 2003, Table 6-5 of the National Resource Conservation Service's National Range and Pasture Handbook, Rev. 1.

² One Animal Unit is equivalent to the forage consumption of a 1000-pound grazer.

