

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Narthecium americanum*

COMMON NAME: Bog Asphodel

LEAD REGION: Region 5

INFORMATION CURRENT AS OF: May 2010

STATUS/ACTION:

Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

New candidate

Continuing candidate

Non-petitioned

Petitioned - Date petition received: May 11, 2004

90-day positive - FR date:

12-month warranted but precluded - FR date:

Did the petition requesting a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? Yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded: Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

Listing priority change

Former LP:

New LP:

Date when the species first became a Candidate (as currently defined): 1990

Candidate removal: Former LP:

A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

- U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
- F – Range is no longer a U.S. territory.
- I – Insufficient information exists on biological vulnerability and threats to support listing.
- M – Taxon mistakenly included in past notice of review.
- N – Taxon does not meet the Act’s definition of “species.”
- X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Liliaceae (Lily)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: New York, New Jersey, Delaware, North Carolina, South Carolina

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE:
New Jersey

LAND OWNERSHIP:

Based on recent GPS surveys, approximately 67% of bog asphodel patches or clusters occur at least partly on State-owned lands, primarily Wharton State Forest. About 7% are located within the Edwin B. Forsythe National Wildlife Refuge. Populations also occur on the Warren Grove Gunnery Range and lands owned by private conservation groups (*e.g.*, New Jersey Conservation Foundation, Forked River Mountain Coalition). Thus, over 75% of this species occurs on protected lands. The remainder is on private lands.

LEAD REGION CONTACT: Martin Miller, 413-253-8615; martin_miller@fws.gov

LEAD FIELD OFFICE CONTACT: New Jersey Field Office, Wendy Walsh, 609-383-3938 ext. 48, wendy_walsh@fws.gov

BIOLOGICAL INFORMATION:

Species Description

Bog asphodel is a perennial herb that grows 25-40 centimeters (cm) high and has basal leaves 10-20 cm long that extend from slender underground rhizomes. The basal leaves are narrow (1-2 millimeters (mm) (Gleason and Cronquist 1991, p. 828); 1.5-3.0 mm (Radford *et al.* 1968, p. 299); 2-5 mm (USFWS 2002, p. 4)), con-duplicate (enfolded lengthwise), stiff, and with parallel veins (7-9 nerves). Culm leaves are few and greatly reduced in length. A dense raceme (2-5 centimeters (cm) long) of small, showy, bright-yellow flowers tops the simple, erect flowering

culm from late June through July. Each flower is made up of six tepals that persist around the fruit (capsule), six stamens with filaments half as long as the tepals, and a superior ovary with a minutely three-lobed stigma. The perianth, raceme, and flowering culm are long-persisting. Capsules are long-pointed, reddish-brown (up to 14 mm long). Seeds are pale yellow, fusiform and long-pointed (Fernald 1950, p. 424; Radford *et al.* 1968, p. 299; Schuyler 1990, p. 2; Gleason and Cronquist 1991, p. 828).

Taxonomy

Bog asphodel was historically and scientifically known by the synonyms *Abama montana* Small, *Abama americana* (Ker-Gawler) Morong, and *Nartheceum ossifragum* (L.) Huds. variety *americanum* (Ker-Gawler) Gray (Stone 1911, pp. 338-339; Fernald 1950, p. 424; Radford *et al.* 1968, p. 299; Gleason and Cronquist 1991, p. 828; NRCS 1999). *Nartheceum californicum* Baker is the only other species within this genus currently recognized in the United States (NRCS 1999). However, Weakley (2010, p. 98) has concluded that historic specimens from North Carolina actually represent a distinct species, *Nartheceum montanum*, stating that “the morphological distinctions (and geographic disjunction) between *N. montanum* and *N. americanum* are as great or greater as those between most species recognized worldwide in the genus.” The generic name comes from the Greek *nartheceion*, meaning a chest or box to store ointments (Fernald 1950, p. 424), likely referring to the capsule’s shape. A common name synonym is yellow asphodel (Fernald 1950, p. 424; NRCS 1999). The U.S. Fish and Wildlife Service (Service) has carefully reviewed the available taxonomic information and has concluded the species is a valid taxon.

Habitat

Bog asphodel is found in savanna areas, usually with water moving through the substrate, as well as sandy bogs along streams and rivers (Stone 1911, pp. 338-339; Fernald 1950, p. 424; Radford *et al.* 1968, p. 299; Schuyler 1990, p. 3; Gleason and Cronquist 1991, p. 828). In the New Jersey Pinelands, savannas are found adjacent to rivers and creeks, often separated by a wooded levee and bordered by an Atlantic white-cedar (*Chamaecyparis thyoides*) swamp. Micro-habitats include open bogs surrounded by Atlantic white-cedar, lowlands near sharp river bends and oxbow meanders, *Sphagnum* bogs, iron ore streamlet seeps, small mat hummocks, quaking bogs, mud flats, sunny borders with Atlantic white-cedar swamps, and transitional areas (ecotones) (Radis 1993, p. 2; Dodds 1996, p. 1; Dodds and Goodwin 1997, pp. 1-5). This plant is intolerant of full shade, and is vulnerable to alterations or succession of its habitat. The early successional savanna conditions that support bog asphodel may be created and maintained by various factors including intermittent flooding from adjacent rivers (Cartica 1999, p. 1 of Appendix C), continual groundwater seepage, oligotrophic conditions, deer browsing, fire, and land-use history of bog iron mining, cedar logging, turf cutting or cranberry farming (Walz *et al.* 2000, p. 1).

Historical Range/Distribution

The historic range of bog asphodel included New York, New Jersey, Delaware, North Carolina, and South Carolina, although the North Carolina specimens are now in question (Weakley 2010, p. 98) The Delaware Natural Heritage Program searches annually for bog asphodel, but has found none (McAvoy pers. comm. 2010).

Current Range/Distribution

Bog asphodel is now extant only within the Pine Barrens region of New Jersey.

Population Estimates/Status

As of 2009, the New Jersey Natural Heritage Program (NJNHP) Database contained records for 66 occurrences of bog asphodel (50 extant and 16 historic). One of the historic occurrences was recently relocated (Kelly 2009, p. 4). All known occurrences are located within a very limited geographical area, encompassing portions of Atlantic, Burlington and Ocean Counties, and three of the 21 major watershed management areas in the State: Mullica, Rancocas, and Barnegat (Kelly *et al.* 2007, p. 2; Kelly 2009, p. 6). From 1999 to 2005, approximately 29 additional extant sites were identified (USFWS 2002, pp. 25-26, 37, 41, 43; Gordon 2002, pp. 14-20; Kelly *et al.* 2007, p. 16; Gordon 2009, pp. 3-5) as well as numerous previously undocumented patches occurring within known sites (Kelly *et al.* 2007, p. ii). Twelve more new occurrences documented by Kelly (2009) are not yet reflected in the NJNHP Database. Because bog asphodel is more or less continuously distributed along those river reaches where suitable habitat occurs (Kelly *et al.* 2007, p. 23; Kelly 2009, p. 5), Kelly (2009, p. 6) has proposed that the NJNHP reclassify the Element Occurrences in its database according to current NatureServe (2004) methodology. The proposed reclassification would reduce the number of Element Occurrences to 18. However, many of the proposed Element Occurrences contain large areas of bog asphodel. Recent surveys increased known acreage occupied by bog asphodel by 76% in and around Wharton State Forest (Kelly *et al.* 2007, p.ii) and by 145% in other parts of New Jersey (Kelly 2009, p. 1). Recent surveys failed to relocate 7 historical sites (Kelly *et al.* 2007, p. 15; Kelly 2009, p. 4), and documented the possible extirpation of one occurrence and one sub-population (Kelly 2009, p. 5). Despite the highly restricted range of the species, populations appear to be relatively stable at least in recent history (~25 years) when systematic surveys have been conducted (Kelly 2009, p. 7).

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Curtailment of its historic range is a primary threat to bog asphodel, representing a loss of habitat and genetic diversity and leaving the species vulnerable to localized threats, natural disasters, and climate change. The Pine Barrens savannas that support bog asphodel provide a scarce, specialized habitat that occurs along only a few slow-flowing creeks or rivers (NatureServe 2009). This savanna habitat supports numerous other species of concern (Walz *et al.* 2000, p. 1; USFWS 2002, pp. 5-7; Kelly *et al.* 2007, p. 2), and has declined from several thousand acres

around 1900 to only a thousand acres in recent decades (NatureServe 2009). Even within its savanna habitats, bog asphodel is a specialist, apparently limited to a relatively narrow range of hydrologic and topographic conditions, tending to occur in wetter areas (USFWS 2002, p. 8; Kelly *et al.* 2007, p. 24). This species has been lost from 4, possibly 5 States, and now occurs on less than 80 acres of land confined to an area only about 30 miles in diameter. Even within New Jersey, bog asphodel is extirpated from 6 watersheds and persists in 4 additional watersheds only as a single occurrence. Distribution across the three watershed management areas supporting the species is uneven, with nearly 88% (by area) concentrated in the greater Mullica River drainage (Kelly 2009, p. 5).

Outright habitat destruction from wetland filling, draining, flooding, and conversion to commercial cranberry bogs (USFWS 2002, pp. 9-10) may have contributed to the curtailment of this species range, but these are generally historic threats to bog asphodel. The State's Pinelands (N.J.A.C. 7:50), Flood Hazard (N.J.A.C. 7:13), and Coastal Zone regulations (N.J.A.C. 7:7E) prohibit destruction of listed species habitat from regulated activities. The Freshwater Wetlands Protection Act (N.J.S.A. 13:9B-1 *et seq.*) does not extend endangered species protections to plants, but few (if any) bog asphodel populations would fall under this authority alone, and authorization of large-scale wetland destruction is now rare.

Indirect effects of upland development (*e.g.*, sedimentation, non-point source pollution, changes in pH, introduction of invasive species, hydrologic change including lowered water tables) are significant threats to other wetland-dependant listed species in New Jersey. Where it occurs on protected lands, however, bog asphodel is largely buffered from these impacts. For the remaining portion of the population (<25%), sustained human population growth and the resultant development pressure are threats, but the New Jersey Pinelands, Coastal Zone, Flood Hazard, and Storm Water regulations are expected to prevent the most severe indirect effects of future development (see discussion of regulatory mechanisms, below).

From 1990 to 2000, counties supporting populations of bog asphodel experienced human population growth of between 7.2 and 17.9 percent (U.S. Census Bureau 2004). Continued population growth in southern New Jersey could threaten to draw down water tables or divert surface waters for human use. Water demands could potentially be heightened by climate change. Increased water extractions could have localized or even range-wide impacts to bog asphodel. However, Pinelands (N.J.A.C. 7:50-6.86) and Water Allocation (N.J.S.A. 58:1A) rules regulate water extraction, particularly restricting transfers of water resources out of the Pinelands Area. The Pinelands Commission recently completed a hydrologic study to determine how water-supply needs may be met while protecting the aquifer system and avoiding adverse ecological impacts.

Impacts from recreational activities such as hiking, camping, and canoeing are minor, but trampling, erosion, and siltation caused by off-road vehicle (ORV) use may represent a more substantial threat (Radis 1993, p. 7; Cartica 1995a, p. 6; USFWS 2002, p. 9). Unauthorized ORVs are a wide-spread and well-documented problem within the range of bog asphodel (NJDEP 2002). Damage from ORVs has been noted at 5 bog asphodel sites in Wharton State

Forest alone (USFWS 2002, p. 10).

B. Overutilization for commercial, recreational, scientific, or educational purposes.

Recreationists picking wildflowers (USFWS 2002, p. 9) may be drawn to the attractive flowers and seedpods of bog asphodel, leading to declines in areas visible from trails, roadways, and streams. In addition, bog asphodel may be over collected by botanists or trampled in the course of scientific surveys or research. No evidence exists that these are major threats to this species.

C. Disease or predation.

Although not considered a major threat, deer and geese are known to occasionally crop some of the flowering culms. Deer forage in bog asphodel habitat quite extensively and will feed on the plant. Kelly *et al.* (2007, p. 23) report herbivory of bog asphodel flower heads at all sites examined, ranging widely from 3% to 42% of flowers consumed. Seed predation by long-horned grasshoppers has been documented (Dodds and Goodwin 1997, p. 5), although little is known about the frequency and intensity of this predation on bog asphodel seed capsules. No other diseases or predators are known to adversely affect bog asphodel populations.

D. The inadequacy of existing regulatory mechanisms.

Bog asphodel is listed as endangered under New Jersey's Endangered Plant Species List Act (NJAC 7:5C), but the law does not provide regulatory protection from collection or habitat loss. More than 75% of bog asphodel occurs on protected lands, where regulations are generally adequate to protect this species but enforcement can be lacking. The boundaries of Batsto Natural Area were revised to include 35% of known bog asphodel occurrences within this most protective classification of State land. Most bog asphodel occurrences in Batsto Natural Area are demonstrably secure (USFWS 2002, p. 9).

Where bog asphodel populations occur on private lands in the New Jersey Pinelands Area, land use is regulated by the Pinelands Commission (Commission) including issuance of State-assumed Clean Water Act Section 404 permits. Under the Pinelands Comprehensive Management Plan, the Commission is to prohibit development unless designed to avoid irreversible adverse impacts upon the survival of any local populations of federally or State-listed plant or animal species (N.J.A.C. 7:50-6.27 and 6.33). Pinelands regulations require 300-foot wetland buffers (N.J.A.C. 7:50-6.14). Outside the Pinelands Area, State protections for bog asphodel are less comprehensive, but all remaining populations occur within the Coastal Zone. New Jersey's Coastal Zone rules regulate some upland developments, extend protections to listed plants (N.J.A.C. 7:7E-3.38), and provide for buffers wider than those required by the Freshwater Wetlands Protection Act if necessary to protect listed species (N.J.A.C. 7:7E-3.28). The Flood Hazard rules require 150-foot stream buffers for 1 mile upstream of bog asphodel occurrences (N.J.A.C. 7:13-4.1(c)(2)iii). The Stormwater Management rules (N.J.A.C. 7:8) include water quality, peak flow, infiltration, and Low Impact Development requirements for most new developments.

E. Other natural or manmade factors affecting its continued existence.

Succession to Atlantic white cedar swamps has been cited as a threat (Dodds 1996, pp. 11-12), but more research is needed. Suppression of natural wildfires that retard succession may be a factor (USFWS 2002, p. 8-9; Kelly *et al.* 2007, p. 5). Kelly *et al.* (2007, p. ii) found significant decreases of bog asphodel cover, density, and flowering, and significant increases in leaf length, in relation to increasing canopy cover. Kelly *et al.* (2007, p. 24) also found >20% of the total distribution of bog asphodel in cedar forests, and concludes (p. 25) that if these areas are less conducive to bog asphodel, it may take several decades or even centuries to bring about the complete extirpation of the species in many areas.

Beaver-induced flooding is considered a natural threat to bog asphodel (Schuyler 1990, p. 4). Conversely, beaver have been providing hydrological support for bog asphodel habitat at one site on the Batsto River and one site on the Oswego River (USFWS 2002, p. 10).

To date, climate change has not been evaluated as a threat to bog asphodel. Altered patterns of precipitation and drought could impact the species' specialized savanna habitats. Bog asphodel could be especially vulnerable giving its highly restricted range. There is high uncertainty regarding the magnitude of this threat to bog asphodel.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

A Candidate Conservation Agreement was signed in November 2002 that covers bog asphodel sites occurring within Wharton State Forest, New Jersey. This conservation agreement provides guidance to New Jersey Department of Parks and Forestry land managers to ensure the conservation, protection, and survival of bog asphodel within Wharton State Forest. Through this agreement and associated funding, Kelly *et al.* (2007) conducted a thorough survey of known bog asphodel occurrences in and around Wharton State Forest, documented 24 new occurrences in this geographic region, established monitoring methods and permanent plots, and studied basic biology such as shade tolerance, flowering frequency, density, pollination, and herbivory. Service funding to support bog asphodel conservation activities on the Wharton State Forest has ended; the New Jersey Department of Parks and Forestry will no longer be implementing proactive bog asphodel conservation activities within the forest.

With the Service's support, New Jersey Department of Parks and Forestry produced a comprehensive series of publications on population surveys for bog asphodel, namely Windish (1993) for West Branch Wading River and Oswego River corridors; Hill (1993) for Wharton and Lebanon State Forests; Radis (1993) for the Batsto River corridor, Wharton State Forest; and Gordon (1996) for Atlantic and Burlington Counties. Schuyler (1995) surveyed historical and known bog asphodel populations on private lands. Moreover, New Jersey Department of Parks and Forestry produced the confidential *Handbook of Nartheceium americanum Populations on State Owned and Managed Lands*, summarizing site-specific survey results, potential threats, and preliminary management recommendations (Cartica 1995b).

Also with the Service's support, the New Jersey Department of Parks and Forestry published the results of an investigation on hydrology and succession at ten sites populated with bog asphodel (Dodds 1996) and revised the boundary of Batsto Natural Area within Wharton State Forest, incorporating approximately 62 percent of bog asphodel's then-known global occurrences into the new boundary and providing bog asphodel with the most protective designation available for State-owned conservation lands (Cartica 1996). However, without adequate funding, active management on State lands will not occur. Plans for active management of bog asphodel, as well as conservation plans and enhancement measures for bog asphodel populations on State-owned lands were prepared by Dodds (1997a; 1997b), Dodds and Cartica (1997), and Dodds and Goodwin (1997).

Approximately 10 years ago, *de novo* surveys were conducted in suitable areas identified using Geographic Information System technology to locate potential habitat for bog asphodel in areas that had not been surveyed in the past (Breden *et al.* 1998). The surveys resulted in the discovery of a new bog asphodel population comprising a few thousand individuals. A Service-funded survey of the Middle and South Branches of the Forked River was recently completed (Gordon 2009), providing updated information on the extent and condition of known sites as well as *de novo* searches that did not result in documentation of any new populations. Surveys of nearly all other known populations, as well as *de novo* searches within the species known range and potential habitat within the Great Egg Harbor River watershed were conducted in 2008 and 2009 (Kelly 2009, p. 1).

In 2009, the Service funded a small study by the Forked River Mountain Coalition to test the response of bog asphodel to removing shrubs and small cedars. Results will not be available for several years.

Bog asphodel is not included as a species of conservation concern within State Wildlife Action Plans because the species is a plant and the State plans address wildlife only.

SUMMARY OF THREATS

Curtailed of its historic range is a primary threat to bog asphodel. Other significant threats include unauthorized ORV use, natural succession possibly accelerated by fire suppression, and potentially climate change. Lesser threats include indirect effects of upland development, future increases in water extraction for human use, impacts from recreational activities, collection, herbivory, and beaver activity. Because the range of bog asphodel is currently limited to New Jersey's Pinelands Area and Coastal Zone, regulatory protections are generally adequate. More than 75% of bog asphodel occurs on protected lands, although enforcement can be lacking. Outright habitat destruction from wetland filling, draining, flooding, and conversion to commercial cranberry bogs likely contributed to the curtailment of this species' range, but these are generally historic threats to bog asphodel.

The Service finds that this species is warranted for listing throughout all its range, and, therefore, finds that it is unnecessary to analyze whether it is threatened or endangered in a significant

portion of its range.

For species that are being removed from candidate status:

___ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

RECOMMENDED CONSERVATION MEASURES:

- Establish long-term monitoring.
- Develop recommended practices for managing succession.
- Pursue landowner protection and management agreements.
- Identify hydrologic needs of the species and develop recommendations for establishing protective buffers around wetland habitats supporting the species.
- Evaluate ORV impacts across the species range.
- Evaluate potential effects of climate change on bog asphodel habitat.
- Investigate re-introduction of the species to other states within its historic range.
- Investigate long-term seed storage at a qualified botanical institution.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

Curtailement of its historic range, unauthorized ORV use, future increases in water extraction, and natural succession represent moderate threats to bog asphodel. Low-magnitude threats include impacts from recreational activities, indirect effects of upland development, collection, herbivory, and beaver activity. High-magnitude threats (wetland destruction) are generally historic and no longer occurring on a significant scale within the current range of bog asphodel. The magnitude of threat posed by climate change has not yet been evaluated.

Imminence:

Several low-magnitude threats and three of the four moderate-magnitude threats (all except future increases in water extraction) are currently ongoing and expected to continue.

Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed? Yes

Is Emergency Listing Warranted? Based on the best available scientific information, emergency listing is not warranted at this time.

DESCRIPTION OF MONITORING:

Information regarding the status of the species is being monitored through review of any changes in information within the New Jersey Natural Heritage Database and through coordination with New Jersey Natural Heritage Program staff, species experts, and environmental consultants. Nearly all bog asphodel populations were monitored between 2004 and 2008.

COORDINATION WITH STATES

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: New Jersey, Delaware

Indicate which State(s) did not provide any information or comments: New York, North Carolina, and South Carolina.

LITERATURE CITED

Citations marked with an asterisk (*) are available as agency reports or other unpublished literature.

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- * _____. 2009. Survey of bog asphodel (*Narthecium americanum*), Knieskern's beaked-rush (*Rhynchospora knieskernii*) and other rare species in the Middle Branch and South Branch Watersheds of the Forked River, Lacey Township, Ocean County, New Jersey. Forked River Mountain Coalition, Forked River, New Jersey. 24 pp. + Appendices

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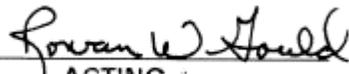
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PERSONAL COMMUNICATIONS

McAvoy, W. 2010. Botanist. Delaware Natural Heritage Program, Dover, Delaware.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  Date: 5/26/10
Acting Regional Director, U.S. Fish and Wildlife Service

Concur: 
ACTING
Director, Fish and Wildlife Service Date: October 22, 2010

Do not concur: _____
Director, Fish and Wildlife Service Date _____

Director's Remarks:

Date of annual review: May 3, 2010
Conducted by: Wendy Walsh, New Jersey Field Office

(Revised 05/03/2010)