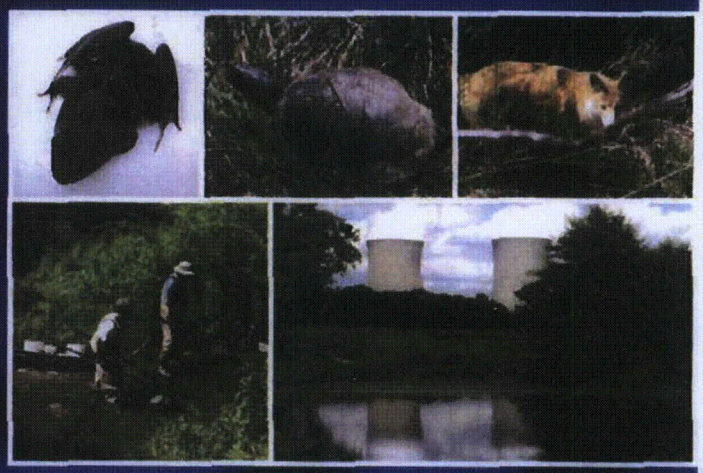
Final

A Field Survey of Terrestrial Fauna at the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania



Submitted to:

AREVA NP, Inc.
Marlborough, MA

September, 2008

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A Field Survey of Terrestrial Fauna at the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania

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EXECUTIVE SUMMARY

A series of studies was conducted by Normandeau Associates to assemble a baseline inventory of terrestrial fauna at the Bell Bend Nuclear Power Plant (BBNPP) site. Studies were initiated in July 2007 and continued through September 2008. These studies included surveys of birds, mammals, reptiles and amphibians to determine the presence or absence of "important" species as defined and required by NUREG-1555 (NRC 1999). Two additional surveys were conducted at the request of regulatory agencies: the United States Fish and Wildlife Service (USFWS) requested a mist net survey to determine the presence of Indiana bat (*Myotis sodalis*), a federally- and state-listed endangered species; and the Pennsylvania Department of Conservation and Natural Resources (DCNR) requested a butterfly survey to investigate the presence of five butterfly species of special concern.

Normandeau studies resulted in the observation of 123 species of birds, 23 species of mammals, 12 species of reptiles, and 15 species of amphibians on the BBNPP site. No Indiana bats were captured during the mist net survey; however, potential roosting and maternity den sites were observed in forested areas of the BBNPP site in the form of exfoliating bark of large, often dead, trees. Two butterfly species identified by DCNR as of special concern were observed, long dash (*Polites mystic*) and black dash (*Euphyes conspicua*); however, long dash has since been removed from the Pennsylvania Natural Diversity Inventory (PNDI) tracked species due to a recent revision of state ranks.

Twenty-three species of terrestrial fauna have been identified as potentially "important" for the BBNPP site. Sixteen of those species fall in the category of rare, threatened, or endangered (Indiana bat, eastern small-footed myotis, northern myotis, Allegheny woodrat, peregrine falcon, bald eagle, osprey, redbelly turtle, timber rattlesnake, eastern hognose snake, eastern spadefoot,

northern pearly-eye, long dash, mulberry wing, Baltimore checkerspot, black dash); three species were classified as commercially or economically important (white-tailed deer, black bear, wild turkey); and four other species were classified as ecologically important (white-footed mouse, deer mouse, meadow vole, scarlet tanager). Of the 23 potentially "important" species, nine were mammals, five were birds, three were reptiles, one was an amphibian, and five were insects.

Of the 16 rare, threatened, or endangered species that potentially may occur at the BBNPP site, evidence of only four of those species were detected during the studies. They include northern myotis, peregrine falcon, black dash and long dash: Four northern myotis (Pennsylvania candidate rare) were captured during the Indiana bat mist net survey; one peregrine falcon (Pennsylvania endangered) was observed during the vertebrate fauna survey; and during the butterfly survey one long dash (no longer listed) was captured, two black dash were captured, and eight to ten more black dash (Pennsylvania species of special concern) were observed.

INTRODUCTION

Bell Bend Nuclear Power Plant (BBNPP) is proposed to be sited adjacent to the Susquehanna Steam Electric Station (SSES) in Salem Township, Luzerne County, Pennsylvania (Figure 1). Normandeau Associates, Inc. was contracted by AREVA NP, Inc. to conduct a baseline inventory of terrestrial fauna on and adjacent to the proposed BBNPP Owner Controlled Area (OCA) and to determine the presence or absence of "important" species as defined and required by NUREG-1555 (NRC 1999). NUREG-1555 defines important species as: 1) species listed or proposed for listing as threatened, endangered, candidate, or of concern in 50 CFR 17.II and 50 CFR 17.12 (CFR, 2007), by the U.S. Fish and Wildlife Service, or the State in which the project is located; 2) commercially or recreationally valuable species; 3) species essential to the maintenance and survival of rare or commercially or recreationally valuable species; 4) species critical to the structure and function of local terrestrial ecosystems; or 5) species that could serve as biological indicators of effects on local terrestrial ecosystems.

A review of relevant literature and a series of studies to characterize the terrestrial fauna of the BBNPP site (site, as used in this report, includes all of the owner controlled area) were initiated in July 2007 and continued through September 2008. These studies included surveys of birds, mammals, reptiles and amphibians, and specific investigations to determine the presence or absence of (1) a federally- and state-listed endangered species, Indiana bat (*Myotis sodalis*), and (2) five butterfly species of special concern. The purpose of this report is to present the results of these literature searches and terrestrial fauna studies conducted by Normandeau Associates.

Personnel

This terrestrial fauna report for the BBNPP site is the product of efforts from a well-trained, experienced team of terrestrial ecologists and field biologists. Avian and mammalian field work was accomplished by fish and wildlife biologists Jayme Schaeffer, Charles Dix, Enn Kotkas, and Rebecca Smith. Senior Wetland Scientist, Keith Maurice, provided data and analysis of habitat and vegetation. Entomologist Daniel Bogar conducted a survey for butterfly species of special concern. Herpetologist Dr. Rudolf Arndt conducted a survey of reptiles and amphibians. Bat Specialist Dr. Karen Campbell conducted an Indiana bat mist net survey with assistance from Jayme Schaeffer. Shelly Sherman provided GIS/graphics support for figures. Melonie Ettinger, Brenda Strouse, and Connie Booz provided secretarial and computer support for tables and text. Principal Scientist Dr. Gary Alt wrote the report, and Project Manager, Robert Blye, coordinated the efforts of the entire terrestrial fauna studies team. Paul Harmon was Normandeau's Principal-In-Charge and overall Project Manager for all Bell Bend Environmental Studies.

BBNPP SITE STUDY AREA

The BBNPP site is located in Salem Township, Luzerne County, Pennsylvania, adjacent to Susquehanna Steam Electric Station along the Susquehanna River in an area of open deciduous woodlands interspersed with grasslands, previously cultivated fields, and orchards. Land use categories within BBNPP site (owner controlled area) consists of 882 acres: 402.5 acres (162.9 hectares) of forest (45.6%), 251.9 acres (102.0 hectares) of agriculture (28.6%), 196.0 acres (79.3 hectares) of wetlands (22.2%), 21.0 acres (8.5 hectares) of urban or built-up (2.4%), 6.3 acres (2.5 hectares) of barren (0.7%) and 4.3 acres (1.7 hectares) of water (0.5%). A map showing the location of plant communities at the BBNPP site is provided in Figure 1. A detailed description of the vegetation of the BBNPP site is provided in "A Field Survey of Flora at the Proposed Bell Bend Nuclear Power Plant (NAI 2008).

BIRDS

There is a rich history of research studies from which to glean an inventory of avifauna for the general area of the proposed BBNPP site. Environmental studies between 1977 and 1994 (Ecology III 1995), within 5 miles (8 km) of the Susquehanna Steam Electric Station, adjacent to the proposed location for the BBNPPsite, reported 245 species of birds (Table 1). Gross (2004) reported 247 bird species (126 breeding bird species) as having been observed on the Pennsylvania Important Bird Area #50, of which the BBNPP site is a part. One hundred and sixteen different species of breeding birds were identified for areas close to the BBNPP site in both the first (1984-1989) and second (2004-2008) Pennsylvania Breeding Bird Atlas (CMNH 2008). Bird species likely to occur in the vicinity of the BBNPP site are presented in Table 1, based on results of the above-mentioned studies.

Though a wealth of historic bird observation data exists for the general area, historically, the purpose of this study was to intensively search the BBNPP site for current use of birds, and other terrestrial fauna, to establish a baseline inventory, and to determine the presence or absence of species which meet importance criteria as defined by NUREG-1555 (NRC 1999).

Methods

A vertebrate fauna survey was used to develop inventories of birds, mammals, reptiles and amphibians that use the proposed BBNPP site. The area was divided into 33 survey sectors (Figure 2). Each sector was determined by habitat type (forest, field, orchard, etc.) and topographical features (roads, transmission lines, stone walls, etc.).

Two-day sampling periods were scheduled biweekly for most of the 1-year duration survey which ran from mid-October 2007 through mid-September 2008.

The schedule established which sectors would be sampled on which days in such a way that all sectors were sampled after every 4 days in the field. Sampling was reduced or curtailed when new species observations were no longer observed, for example, from mid-December until early-February, after fall migration and before spring migration.

During each sampling event, each selected sector was walked through thoroughly for approximately an hour. Observations were recorded for all bird, mammal, reptile, and amphibian species. This included whether they were heard, observed directly, or if sign of their presence, such as tracks or scats, were observed. Binoculars were used for most direct observations to facilitate specific identification on vertebrates. All avian species observed within the study area were recorded, including those that flew over the area or were heard in the area.

Results and Discussion

One hundred and twenty-two different bird species were observed during 41 field-days of terrestrial fauna observations between October 16, 2007 and September 10, 2008 at the proposed BBNPP site (Table 1). Eighty-three of those species were identified as likely breeding, and 39 species were identified as migrants or winter residents (observed only outside of normal breeding dates or not in appropriate habitat (Table 1).

Though our efforts were restricted only to the BBNPP site and to only 41 field-days of data collection, results in many respects were comparable to earlier, long-term, broader geographic area studies (Table 1) and typical of other rural landscapes in northeastern Pennsylvania. As expected, forest interior birds such as scarlet tanager, red-eyed vireo, ovenbird, and wood thrush were found mostly in larger blocks of forest; while field sparrow, killdeer, and eastern bluebird were found in or near fields.

Table 2 provides statistics on seasonal and annual relative abundance of bird species observed during our study. In terms of annual relative abundance, or the total number of individuals observed throughout the year-long study, the top ten species were as follows: (1) Canada goose, 1,614; (2) European starling, 1,298; (3) American robin, 713; (4) American crow, 564; (5) blue jay, 546; (6) song sparrow, 485; (7) mourning dove, 409; (8) gray catbird, 397, (9) tufted titmouse, 321; and (10) black-capped chickadee, 306. Of these species, only American crow remained in the top 10 for abundance in all four seasons. American robin was in the top four in all seasons but winter. Blue jay was in the top five for all seasons but summer. Gray catbird was the most abundant species observed in summer, the 12th most abundant in spring, 22nd most abundant in fall, and was completely absent during winter, undoubtedly due to its southward migration.

Table 2 also provides statistics on seasonal and annual frequency of occurrence (percent of field-days observed) of bird species observed during our study. Blue jay was the only species observed on each of the 41 field days. American crow was observed on 98% (40/41) of the field days; American robin, black-capped chickadee, northern cardinal, and tufted titmouse were observed on 95% (39/41) of the field-days; mourning dove on 93% (38/41) of the field-days; downy woodpecker and song sparrow were observed on 88% (36/41) of the field-days, and red-tailed hawk and yellow-shafted flicker were observed on 85% (35/41) of the field-days.

None of the nearly 250 bird species reported from all studies at or near the BBNPP OCA, including the present study, are listed on the federal threatened or endangered list; however, 10 species are listed on the state threatened or endangered list. They include bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), osprey (*Pandion haliaetus*), short-eared owl (*Asio flammeus*), upland sandpiper (*Bartramia longicauda*), American bittern (*Botaurus lentiginosus*), least bittern (*Ixobrychus exillis*), great egret (*Casmerodius alba*),

black tern (*Chlidonias niger*), and sedge wren (*Cistothorus platensis*). Of these 10 state-listed threatened or endangered species that could occur in the site vicinity, six are migrants with no history of local nesting and one, American bittern, is a migrant that may have historically nested in the area, although no breeding activity has been documented recently (Ecology III 1995).

Based on correspondence with regulatory agencies, historical and current study results presented above, five bird species have been identified as potentially "important" at the BBNPP site (Table 3) according to criteria defined in NUREG-1555 (NRC 1999). Three bird species qualify as rare (bald eagle, peregrine falcon, and osprey), one species as commercially or recreationally valuable (wild turkey), and one species because of its ecological importance as a biological indicator of effects on local terrestrial ecosystems (scarlet tanager). Discussion of these "important" bird species will be presented, along with other important fauna species, in the Important Species section below.

MAMMALS

According to the Pennsylvania Biological Survey, 64 species of native and introduced mammals currently reside in Pennsylvania (PBS 2008) (Table 4). Virtually all of them could occur in the vicinity of the BBNPP site, based on range maps (Merritt 1987), with the possible exception of eastern spotted skunk (*Spilogale putorius*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), and least shrew (*Cryptotis parva*).

Methods

Two primary methods were used to develop an inventory of mammals that occupy the proposed BBNPP site: (1) direct observations from the vertebrate fauna survey and (2) mammal trapping. Detailed methods for direct observations provided by the vertebrate fauna survey are presented in the birds' Methods section above. Since mammals are difficult to observe directly, we also had to rely heavily on tracks, scat, and other indicators for detection of their presence.

Mammal trapping methods followed recommended guidelines of the American Society of Mammalogists to keep captive animals alive, uninjured, well-provisioned, and in comfortable microclimatic conditions while awaiting subsequent processing and release (ASM 2008). Sherman live traps were used for capturing small mammals (mice, voles, shrews) and Tomahawk traps (4 sizes) were used for capturing medium-sized mammals such as raccoons, opossums, groundhogs, and cottontails.

Small mammal trap lines consisted of a linear arrangement of 10 Sherman traps, set approximately 60-75 feet (18-23 meters) apart. The medium-sized Tomahawk mammal traps were placed individually and opportunistically to take advantage of animal travel corridors and habitat conditions. GPS coordinates were recorded for each trap location. In addition, trap locations were marked with uniquely-labeled flagging (letters and sequential numbers) to identify trap location and type, and to insure that all traps were located and checked each day. An effort was made to set traps in each of the major habitat types (upland forest, upland scrub/shrub, old fields, etc.) on the BBNPP site to attain a representative sample of mammals. A map showing the location of where mammal traps were set on the BBNPP site is provided in Figure 2. Small mammal traps were baited with a mixture of peanut butter and oats (Quaker Old-Fashioned). Tomahawk traps, for medium-sized mammals, were baited with pieces of apples and carrots, or wet cat food (Nine Lives Ocean Whitefish and Tuna) and sardines.

Trapping occurred during eight periods between May 13, 2008 and September 10, 2008. Trapping periods consisted of 3 days each, where traps were set the evening of the first day and removed on the morning of the third day. During days of trapping, traps were set between 3:30 and 6:30 pm, remained set all night, then checked and closed between 6:00 and 10:00 am. Traps were closed from morning until late afternoon and were set in shaded areas whenever

possible to avoid capturing animals during the middle of the day when overheating could be lethal.

Small mammals were removed from Sherman traps and placed in holding containers until all traps were checked, then processed and taken back close to their capture sites and released. Medium-sized mammals were processed at the trap site, as soon as the trap was checked, and released at the trap site immediately after processing. Processing included removal of the animal from the trap, species identification, determination of sex, and then release. Some individuals were also weighed and photographed for later reference.

Results and Discussion

Sixteen mammal species were detected on the BBNPP site during 41 days of terrestrial vertebrate surveys between October 16, 2007 and September 10, 2008 (Table 5). Nearly two-thirds of all the mammalian detections involved only four species: white-tailed deer (*Odocoileus virginianus*) and eastern gray squirrel (*Sciurus carolinensis*) were detected on 88% (36/41) of the field-days, eastern chipmunk (*Tamias striatus*) on 63% (26/41), and eastern cottontail (*Sylvilagus floridanus*) on 54% (22/41) of the field-days (Table 5). Insufficient data were available to say much about seasonality differences other than eastern chipmunk was observed on virtually all visits except the period between October 23, 2007 and February 27, 2008, when they were likely to be less active above ground (Table 5).

Fifteen different mammalian species were captured as a result of 1,444 trap-nights effort between May 13, 2008 and September 10, 2008 on the BBNPP site. White-footed mouse (*Peromyscus leucopus*) and deer mouse (*Peromyscus maniculatus*) were, by far, the most common mammals captured. Of the 213 mammalian captures, 152 (71%) were *Peromyscus* spp., either white-footed mice or deer mice. Other captures, by species, were as follows: 12 northern

short-tailed shrews (*Blarina brevicauda*), 11 meadow voles (*Microtus pennsylvanicus*), 10 southern flying squirrels (*Glaucomys volans*), 6 Virginia opossums (*Didelphis virginiana*), 5 eastern cottontails (*Sylvilagus floridanus*), 4 eastern chipmunks (*Tamias striatus*), 4 meadow jumping mice (*Zapus hudsonius*), 4 raccoons (*Procyon lotor*), 1 house mouse (*Mus musculus*), 1 long-tailed weasel (*Mustela frenata*), 1 mink (*Mustela vison*), 1 striped skunk (*Mephitis mephitis*), and 1 groundhog (*Marmota monax*). The capture effort did produce seven additional mammalian species that were not detected during the terrestrial vertebrate survey.

The combined effort of the terrestrial vertebrate survey and the trapping study identified a total of 23 mammalian species on the BBNPP site. None of these 23 species are considered rare, threatened or endangered. However; at the request of the U.S. Fish and Wildlife Service, a special mist-net study was conducted at the BBNPP site to check for the presence of Indiana bats (federally- and state-listed as endangered) and which is known to occupy hibernacula within 5 miles (8 km) of the BBNPP site. Indiana bat was not detected during the mist-netting study. A detailed description of the bat study and its results are presented later in this report under the title "Indiana Bat Mist Net Survey" in the Important Species section, and Dr. Campbell's original report is available in its entirety in Appendix B.

Nine mammalian species have been identified as potentially "important" at the BBNPP site (Table 3) according to criteria defined in NUREG-1555 (NRC 1999). Four species qualify as rare (federally- or state-listed as threatened or endangered): Indiana bat (*Myotis sodalis*), eastern small-footed myotis (*Myotis leibii*), Allegheny woodrat (*Neotoma magister*), and northern myotis (*Myotis septentrionalis*). Two species meet the criteria of being commercially or recreationally valuable: white-tailed deer (*Odocoileus virginianus*) and black bear (*Ursus americanus*). Three additional species are "important" to the structure and function of the local terrestrial ecosystem: white-footed mouse (*Peromyscus*

leucopus), deer mouse (*Peromyscus maniculatus*), and meadow vole (*Microtus pennsylvanicus*). A discussion of these "important" mammalian species is provided in the Important Species section below.

REPTILES AND AMPHIBIANS

Seventy-four species of native, extant reptiles and amphibians currently occur in Pennsylvania according to a publication of the Pennsylvania Fish and Boat Commission (PFBC 2008a). Thirteen (18%) of those species are classified as state endangered, threatened, or candidate and an additional 29 (39%) are classified as species of special concern (PFBC 2008a) (Table 6). Based on available range maps (POHA 2008) only one endangered species, eastern spadefoot (*Scaphiopus holbrookii*); one threatened species, redbelly turtle (*Pseudemys rubriventris*); and one candidate species, timber rattlesnake (*Crotalus horridus*) may possibly occur at the BBNPP site (Table 6). Using similar criteria, 15 of Pennsylvania's 29 species of special concern have ranges that may include the BBNPP site (Table 6). They include northern copperhead (*Agkistrodon contortrix*), eastern hognose snake (*Heterodon platirhinos*), smooth green snake (*Liochlorophis vernalis*), eastern ribbon snake (*Thamnophis sauritus*), eastern box turtle (*Terrapene carolina carolina*), spotted turtle (*Clemmys guttata*), wood turtle (*Glyptemys insculpta*), map turtle (*Graptemys geographica*), northern leopard frog (*Rana pipiens*), northern cricket frog (*Acris crepitans crepitans*), Fowler's toad (*Bufo fowleri*), eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*), Jefferson salamander (*Ambystoma jeffersonianum*), marbled salamander (*Ambystoma opacum*), and four-toed salamander (*Hemidactylium scutatum*).

The only reptile or amphibian listed in correspondence from the Pennsylvania Fish and Boat Commission (PFBC 2008b), the regulatory agency responsible for the states' reptiles and amphibians regarding Species Impact Review (SIR) for rare, candidate, threatened, and endangered species at the BBNPP site, was eastern hognose snake (*Heterodon platyrhinos*).

Methods

In an effort to determine presence or absence, relative abundance, and distributions of amphibian and reptilian species at the BBNPP site, especially those potentially "important" species listed above, herpetologist Dr. Rudolf Arndt surveyed the area for 213 hours during 28 field-days between May 21, 2008 and September 7, 2008. Observations were determined largely using five techniques: (1) random opportunistic sampling, (2) cover boards, (3) traps, (4) dip nets, and (5) road searches.

Random opportunistic sampling involved walking throughout the BBNPP site searching for specimens basking, foraging, or hiding under shelter such as logs, old boards, rocks, and dead grass, or by breaking open rotten stumps and logs.

Thirty-four cover boards were placed throughout the area on June 4 and 5 and left there throughout the study, in a variety of habitats. This was done to enhance the possibility of locating reptiles and amphibians known to seek shelter on land from weather conditions and predators, or to seek food. The cover boards were pieces of scrap wood, primarily 1/2-inch to 1-inch-thick plywood, ranging in size from 18 inches by 20 inches (2.5 ft^2, 0.3 m^2) to 4 feet by 8 feet (32 ft^2, 3.0 m^2). The area under cover boards was examined for reptile and amphibian specimens about once every two field-days.

Modified "Faby traps" were placed in runways or rivulets to capture reptiles and amphibians in marshy and aquatic habitats. No bait was used in the traps as they were placed in runways and activated when animals attempted to pass through them. Traps were set so the top was always above water to allow captured animals the opportunity to breathe. Traps were constructed of wire mesh with dimensions of 12 inches long, 5 inches wide, and 4 inches high with a swinging trap door attached at the top on either end which can only be pushed in by a moving animal but cannot be pushed out. Trapping was done in 2-4 day

periods. For animal safety, traps were set at the beginning of each period, checked on the beginning and end of each day, then removed at the end of each trapping period to prevent accidental captures or losses during non-trapping periods.

A dipnet (15 by 16-inch oval; 1/8-inch mesh) was used to capture aquatic amphibians in ponds and streams.

Another method used to inventory reptiles and amphibians was to search roads for live or dead specimens. Many species are attracted to roads to thermoregulate, especially during evening, night, or during a rain, when roads are dissipating heat after a sunny day, or move across roads while foraging.

In addition, observations of reptiles and amphibians were included from the terrestrial vertebrate survey which included 41 field-days between October 16, 2007 and September 10, 2008. A more detailed description of the terrestrial vertebrate survey methods is presented in the Bird Methods section above.

Each individual observation, by species, was plotted on a map of the BBNPP site to determine geographical distributions for each species. Four maps were generated to present results, by species for: (1) snakes, (2) turtles, (3) frogs and toads, and (4) salamanders.

Results and Discussion

Twenty-seven species of reptiles and amphibians were detected, either observed or heard, during the study on the BBNPP site. This included 12 species of reptiles (seven snakes and five turtles) and 15 species of amphibians (eight frogs and toads, and seven salamanders) (Table 6). Locations where observations were made for seven species of snakes are provided in Figure 3; for five species of turtles are provided in Figure 4; for eight species of frogs and toads are

provided in Figure 5; and for seven species of salamanders are provided in Figure 6.

All of these species have range distributions that are widespread throughout the northeastern United States, including large portions of Pennsylvania. None has highly specialized habitat requirements, although those with the most specialized habitats, longtail salamander and northern red salamander, require cool, clean, unpolluted waters, and common map turtle is restricted to large rivers. For a detailed account of specific species observations, see herpetologist Dr. Rudolf Arndt's report, "Reptile and Amphibian Survey at the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania, May through September 2008" provided in its entirety in Appendix A.

Additional species of reptiles and amphibians are expected to occur on the BBNPP site that were not observed during this study. They include smooth green snake (*Opheodrys vernalis*), northern red-bellied snake (*Storeria o. occipitomaculata*), and black rat snake (*Elaphe o. obsolete*). Suitable habitat for all of these species appear to be present on the property; this area is well within their range distribution and they are usually common species. None of these species, however, are federally- or state-listed as threatened or endangered, nor are they even species of special concern in Pennsylvania.

Four "important" rare species of reptiles and amphibians that were not observed at the proposed BBNPP site, but for which there is evidence that their ranges may cover the area of interest, include the eastern spadefoot, redbelly turtle, timber rattlesnake, and eastern hognose snake. Further discussion of these species is provided in the Important Species section below.

IMPORTANT SPECIES

Twenty-three species of terrestrial fauna have been identified as potentially "important" as defined by NUREG-1555 (NRC 1999) for the BBNPP site. Sixteen of those species fall in the category of rare, threatened, or endangered; three species were classified as commercially or economically important; and four other species were classified as ecologically important.

Rare, Threatened, and Endangered Species

Sixteen rare, threatened or endangered species have been identified as potentially occurring on the BBNPP site (Table 3). They include four mammals (Indiana bat, eastern small-footed myotis, northern myotis, Allegheny woodrat), three birds (peregrine falcon, bald eagle, osprey), three reptiles (redbelly turtle, timber rattlesnake, eastern hognose snake), one amphibian (eastern spadefoot), and five butterflies (northern pearly-eye, long dash, mulberry wing, Baltimore checkerspot, black dash).

Indiana bat is federally- and state-listed as endangered, the only federally-listed species that may occur on the BBNPP site. Peregrine falcon and eastern spadefoot are also state-listed as endangered. Five species are listed as state-threatened: Allegheny woodrat, eastern small-footed myotis, bald eagle, osprey, and red-bellied turtle; two as Pennsylvania candidate rare: northern myotis and the timber rattlesnake; and six are listed as species of special concern: eastern hognose snake, northern pearly-eye, long dash, mulberry wing, Baltimore checkerspot, and black dash (Table 3). A brief discussion of each of the 16 rare, threatened, or endangered species that may occur at the BBNPP site is presented below.

Indiana bat

Indiana bat, which is federally- and state-listed as endangered, is known to occupy hibernacula in Luzerne County, within 5 miles (8 km) of the BBNPP site (PPL 2006). To document presence or absence of this endangered species, a mist-net capture survey and habitat evaluation by a qualified bat biologist was requested by the U.S. Fish and Wildlife Service and was conducted during June and July 2008 by Dr. Karen Campbell. Mist net site locations for this survey are provided in Figure 7. Results of this survey are presented below in a section entitled "Indiana Bat Mist Net Survey" and Dr. Campbell's original report, in its entirety, is attached in Appendix B.

During non-hibernating periods (April through mid-November), Indiana bat typically favors sites under exfoliating bark of large, often dead, trees as roosting sites and maternity dens. Though Indiana bat is not known to occur on the BBNPP site, there is suitable forested habitat [loose bark of shagbark hickory (*Carya ovata*), wild black cherry (*Prunus serotina*) and red maple (*Acer rubrum*) and dead snags > 5 inches (13 cm) diameter at breast height (dbh)] that may be used by Indiana bat during non-hibernating periods.

Peregrine falcon

Peregrine falcon is listed as endangered in Pennsylvania. In the vicinity of BBNPP site, its status was listed as "a rare but regular migrant" just over a decade ago (Ecology III 1995). However, in 2007, for the first time in about 47 years, a pair nested and raised young at a cliff site along the Susquehanna River (Brauning 2007), less than 2 miles from the proposed BBNPP site. In 2008, the pair successfully raised young at the same location again. Though a pair was known to be nesting nearby, only one observation of a peregrine falcon was made at the BBNPP site during the 41 field-days of the terrestrial vertebrate survey. It is likely that most peregrine falcon activity was concentrated in locations closer to the river than most of the BBNPP site.

Eastern spadefoot

Eastern spadefoot is currently listed as endangered in Pennsylvania. Though it was not observed during our studies at the BBNPP site, and though the range maps of Conant and Collins (1998), and Hulse *et al.* (2001) do not appear to include the BBNPP site, it was recorded in Luzerne County (the county where the BBNPP site is located) during the original Pennsylvania Herpetological Atlas work between 1997 and 2002 (POHA 2008). It is possible, but unlikely, that eastern spadefoot toad occurs on the BBNPP site.

Allegheny woodrat

Allegheny woodrat is classified as threatened in Pennsylvania with very specific habitat requirements that severely limit its distribution. This mammalian species is almost always found in caves, cliff faces, in boulder piles or talus slopes along mountain tops (Merritt 1987; PGC 2008a). The closest active site where Allegheny woodrat is known to occur is in Carbon County, which borders Luzerne County to the east. However, no observations of this species were made during this study, or previous studies on or near the BBNPP site, and no suitable habitat has been identified.

Eastern small-footed myotis

Eastern small-footed myotis is listed as threatened in Pennsylvania and has been documented in hibernacula within 5 miles (8 km) of the BBNPP site. It is known to hibernate in caves and mine shafts. They have rarely been encountered during non-hibernating periods, so very little is known about habitat requirements or food habits of this rare bat (PGC 2008b). Because there are no caves or mine shafts on the BBNPP site, and no observations of this species were made during the bat mist-netting survey on the area, we have no evidence that eastern small-footed myotis would be significantly impacted by this project.

Bald eagle

Bald eagle is currently listed as threatened for Pennsylvania and was delisted from the Federal Endangered Species List on June 28, 2007 (PGC 2008c). Bald eagle sightings in the project area are increasingly common (Ecology III 1995) and nest sites are known to exist within 10 miles (16 km) of the BBNPP site. However, there are no known nests on the BBNPP site and no observations of bald eagles were made during the terrestrial fauna surveys.

Osprey

Osprey is listed as threatened in Pennsylvania, is a regular and relatively common migrant along the Susquehanna River area near the BBNPP site, and is known to nest within 10 miles (16 km) of the site (Ecology III 1995; PGC 2008d). However, there are no known nests on the BBNPP site and no observations of osprey were made during the terrestrial fauna surveys.

Redbelly turtle

Redbelly turtle is currently listed as threatened in Pennsylvania and, like eastern spadefoot, range maps of Conant and Collins (1998) and Hulse *et al.* (2001) do not include any part of Luzerne County (actually range maps for this species indicate it to be at least 50 miles away), yet it too was recorded (photographed) in Luzerne County during the original Pennsylvania herpetological Atlas work between 1997 and 2002 (POHA 2008). Though this turtle is large and exhibits conspicuous basking behavior that should make it relatively noticeable, we found no evidence in our studies at the BBNPP site that the redbelly turtle resides there.

Northern myotis

The current status of northern myotis, also known as long-eared bat, in Pennsylvania is candidate rare. It is known to occupy hibernacula in Luzerne County near the BBNPP site. Four adult male northern myotis were captured during the bat mist-net survey (discussed in more detail below, in the Indiana Bat Mist Net Survey section). However, the capture of only adult males and no females or young, provides evidence for the existence of roost sites in the area surveyed, but not maternity colonies of females and young. Accordingly, the loss of potential roost trees on the BBNPP site may have a negative impact on at least the male segment of the local northern myotis population.

Timber rattlesnake

Timber rattlesnake is listed as a candidate species of special concern in Pennsylvania and is known to occur in Luzerne County (POHA 2008). However, we found no suitable habitat, such as rock ledges, rock and boulder slides, or relatively wild forested habitat (Hulse *et al.* 2001), for this species on site. Further, the long agricultural and other human-occupation history of the site is usually incompatible with survival of venomous snakes such as timber rattlesnake. We found no evidence that timber rattlesnake resides at the BBNPP site.

Eastern hognose snake

Eastern hognose snake is a species of special concern in Pennsylvania, is known to occur in Luzerne County, and was the only species of reptile or amphibian listed in correspondence from the Pennsylvania Fish and Boat Commission (PFBC 2008b) regarding Species Impact Review for rare, candidate, threatened, and endangered species at the BBNPP site. No evidence of eastern hognose snake was found during our studies at the site. Usually, population density of this species in habitat like that which occurs on this site, if

the species indeed occurs, is low. More optimal habitat for it would be areas with more sand and with a higher population of toads, which it feeds on almost exclusively (Hulse *et al.* 2001). Because of the spectacular anti-predator behavior display of this species, with spreading neck hood, hissing, and mouth-gaping, its presence in an area is usually known by local people, but that did not appear to be the case at this site. Because of the evidence above, we believe this species is either absent or uncommon.

Rare Butterflies

Four butterfly species of special concern, thought to occupy areas near the BBNPP site, were brought to our attention in correspondence with the Pennsylvania DCNR (DCNR 2008). They were northern pearly-eye, long dash, mulberry wing, and Baltimore checkerspot. To determine presence or absence of these butterfly species of special concern on the BBNPP site, at the request of DCNR, a butterfly survey was conducted by an experienced entomologist (Daniel Bogar) during June and July 2008. No northern pearly-eye, mulberry wing, or Baltimore checkerspot butterflies were located during the butterfly survey; however, one long dash butterfly was collected.

In an email correspondence from entomologist Daniel Bogar, dated July 24, 2008, he indicated that two of the four original butterfly species of concern (northern pearly-eye and long dash) were no longer PNDI-tracked species due to a recent revision of the state ranks, but one new species for Luzerne County (black dash) had been added. He collected a pair of black dash and observed at least 8 to 10 more at the BBNPP site during his survey on July 18, 2008. Locations of black dash and long dash observations on the BBNPP site are provided in Figure 8. Occurrence of butterfly species of special concern host plants at the BBNPP site is provided in Table 8.

Commercially and Economically Important Species

White-tailed deer

White-tailed deer is, by far, the most important wild animal economically or recreationally in Pennsylvania. There are more deer hunters (just under a million) in Pennsylvania than any other state and the percentage of all hunters who hunt deer is higher (>90%) in Pennsylvania than for any other state (USFWS 2004). Deer hunting is a very popular activity in Luzerne County and most areas near the BBNPP site. The white-tailed deer is ubiquitous and abundant throughout the BBNPP site. White-tailed deer was one of the most often detected mammals, identified on 88% of the field-days during the terrestrial vertebrate surveys.

Black bear

Black bear was also identified as a commercially or recreationally important mammal. It is one of the premier big game animals in Pennsylvania and provides a great deal of high-quality recreation for hunters. About 125,000 hunters purchase specific licenses to hunt bears in Pennsylvania each year (PGC 2006). The black bear also can be an indicator of ecosystem health, a symbol of wilderness, and have major economic impacts. The black bear was known to occur in the vicinity of the proposed BBNPP site and both tracks and scat of bears were detected during our terrestrial faunal surveys of the property. In addition, some of the workers at the BBNPP site reported seeing bears in the area on several occasions during spring and summer of 2008.

Wild turkey

Wild turkey is one of the most important birds in Pennsylvania both commercially and recreationally. Currently in Pennsylvania greater than 225,000 hunters, more than any other state, are taking in excess of 40,000 turkeys in fall hunting

seasons (PGC 2008e) and it is a very popular activity in Luzerne County and around the vicinity of the proposed BBNPP site.

During the vertebrate fauna survey, 111 wild turkeys were seen: 35 in winter, 62 in spring, 3 in summer and 11 in fall. Wild turkeys were observed on 34% (14/41) of all days in the field: 43% (3/7) in winter; 42% (5/12) in spring; 8% (1/12) in summer; and 50% (5/10) in fall.

Ecologically Important Species

White-footed Mouse, deer mouse, and meadow vole

White-footed mouse, deer mouse, and meadow vole are considered ecologically important mammals to the BBNPP site because of their ubiquitous distribution and abundance. They form an essential link in the complex food web. They represent the major herbivore component bridging the gap between plants (producers) and carnivorous animals (consumers) (Merritt 1987). Two *Peromyscus* species (white-footed mouse and deer mouse) represented over two-thirds (71%) of all mammalian captures during the trapping survey. We included meadow vole here even though we only captured 11 in our trapping effort, because they are known to be abundant throughout Pennsylvania, are a major prey species, and are very cyclic in abundance (Merritt 1987). We suspect that they were under-represented in our trapping effort, perhaps due to being at the low end of their abundance cycle. Abundance and wide distribution of these small mammals likely play an important role in reproductive success and survival of many predators in the local terrestrial ecosystem including foxes, raccoons, skunks, weasels, hawks, owls, and snakes (Merritt 1987).

Scarlet tanager

Scarlet tanager is included as an important species because it can serve as a biological indicator of effects attributable to forest clearing and fragmentation. Given the relatively high frequency of observance at the BBNPP site (it was observed on 50% of summer field days during the terrestrial vertebrate survey) and its forest interior habitat preference, scarlet tanager is appropriate as an indicator species for forest interior habitat.

RARE, THREATENED, AND ENDANGERED SPECIES SURVEYS

Two surveys were conducted specifically for rare, threatened, or endangered species on the BBNPP site. The U.S. Fish and Wildlife Service requested an Indiana Bat Mist Net Survey be conducted to determine the presence of this federally- and state-listed threatened species. Also, the Pennsylvania Department of Conservation and Natural Resources requested a rare butterfly survey to check for species of special concern. The methods, results, and discussion of both of these requested surveys are presented below.

Indiana Bat Mist Net Survey

Introduction

Information was requested of the U.S. Fish and Wildlife Service (USFWS) on December 21, 2007 concerning the presence of species of special concern under their jurisdiction, known to occur within 0.5-mile radius of the BBNPP project area. USFWS responded on April 21, 2008 (USFWS 2008a) that Indiana bat (*Myotis sodalis*), a federally-listed endangered species, was known to occupy hibernacula near the project site and they made comments pursuant to the Endangered Species Act of 1973 regarding protection of endangered and threatened species. They requested an Indiana bat mist net survey be conducted between May 15 and August 15 by a qualified, Service-approved

biologist using the USFWS Indiana Bat Mist Netting Guidelines and that survey results be submitted to the USFWS for review and concurrence. Additionally, they requested the area be surveyed for potential hibernacula (cave and/or mine openings) and recommended that any tree-cutting activities be carried out from November 16 to March 31, while bats are hibernating. If it is necessary to cut trees between April 1 and November 15, they recommended not cutting or physically disturbing trees (live or dead) with a diameter at breast height (dbh) greater than or equal to 5 inches with exfoliating or defoliating bark, cracks, crevices, or holes that could be used by Indiana bats as a potential roost.

Methods

Dr. Karen Campbell, a USFWS-approved biologist, assisted by Normandeau field biologist Jayme Schaeffer, conducted an Indiana Bat Mist Net Survey at the proposed BBNPP site between June 7 and July 11, 2008, following USFWS guidelines. The survey of 32 net-nights effort overall consisted of four mist nets set on each of eight sampling nights. The four mist nets consisted of three three-tier net-panels and one two-tier net panels. Each tier is 10 feet (3 meters) high, therefore, three-tier mist nets were 30 feet (9 meters) high and two-tier mist nets were 20 feet (6 meters) high. The width of both three-tier and two-tier mist nets were made up of a combination of net panels either 20 feet (6 meters) or 30 feet (9 meters) wide to span the sample area.

Sampling was concentrated at two main areas along the most prominent potential bat travel corridors on the property: (1) along a forest road in survey sector W-7 and (2) along the edge of the Beaver Pond, near the W-8/W-9 survey sector boundary, as shown on the map in Figure 8. The forest road area was sampled for five nights with four nets each night, and the Beaver Pond area was sampled for three nights with four nets each night. Survey dates and mist net locations operated each night are supplied in Dr. Campbell's report in Appendix B.

An effort was made to place nets following potential travel corridors along the road in W-7 and along the edge of the Beaver Pond (W-8/W-9), although bat activity was monitored acoustically at a number of other sites to gain a sense of overall activity. Many areas on the property are open and unsuitable for mist-netting (e.g., F-3, F-4, O-1, F-5, F-8, and F-6 in Figure 8), but acoustic monitoring also detected low levels of bat activity in these areas.

Dense vegetation in other areas (e.g., W-7, W-8, and W-9 in Figure 7) restricted the ability to set mist nets, but it is expected that bat flight activity would also be low in these congested locations. There are no permanent or seasonal waterways in this part of the property, which made it difficult to predict potential foraging sites. There is a small pond (Farm Pond) adjacent to the trailer in F-3 and a larger pond (Johnson's Pond) in F-6 (Figure 7), and although there is bat activity over these ponds, it is not possible to capture bats in mist nets in such open locations. Acoustic monitoring of bat activity was conducted at net sites, ponds, and along transects across the property to provide information on bat activity and to guide the placement of mist nets to areas more likely to result in bat captures. Each of the captured bats was tagged with a numbered aluminum wrist-band for future identification.

Bat activity was monitored acoustically using hand-held AnaBat ultrasonic detectors (Titley Electronics). These instruments have a detection frequency range of 10-200 kHz, and sufficient sensitivity to monitor bat echolocation calls flying along the netting corridors as well as above the tree canopy. Acoustic monitoring occurred at 20-minute intervals at each of the mist net sites throughout each sampling night. Additionally, bat activity was monitored at the beginning and end of each sampling night along transects perpendicular to the ridge away from each mist net site. The activity at the ponds was monitored separately, to gain a better appreciation for overall bat activity on the property.

Results and Discussion

Sixteen bats were captured in mist nets during eight sampling nights, involving 32 net-nights effort, between June 7 and July 11, 2008. Three different bat species were captured: 8 little brown bats (*Myotis lucifugus*), 4 big brown bats (*Eptesicus fuscus*), and 4 northern long-eared bats (*Myotis septentrionalis*). In terms of sex, age and reproductive status of the 8 little brown bats, 5 were adult females (4 lactating and 1 pregnant) and 3 were adult males; of the 4 big brown bats, 3 were females (2 lactating and 1 juvenile) and 1 was a juvenile male; and all 4 of the long-eared bats were adult males. Specific details showing date of capture and net locations are provided in the original "Report on Bell Bend Nuclear Power Plant Indiana Bat Mist Net Survey" in Appendix B.

Capture data reflects the generally low level of bat activity detected during acoustic monitoring in the areas sampled, which was fairly uniform at each of the net sites as well as along transects through the surrounding area. Bat activity was uniformly low along the road in vertebrate survey sector W-7 (Figure 7), starting at less than one bat pass per minute (<60/hour) at dusk as the nets were set, and dropping off through the survey period each night to less than 0.1 bat passes per minute (4-5/hour) after midnight. Generally, activity was a bit higher by the beaver pond, starting at four or five bat passes per minute at dusk, dropping to one or two passes per minute around midnight and falling off afterwards to less than one pass per minute. Temperatures were typically hot and humid at dusk throughout the survey period (daytime averages over 85°F, 29 °C), and remained elevated throughout the sampling each night, except for July 10, 2008 when the temperature at midnight had dropped to 54°F (12°C). There were no captures that night.

Most of the activity was recorded from bats flying below canopy level, lower than the three-tier (30-foot or 9-meter high) mist nets, so the acoustic monitoring represents a reasonable estimate of bat activity along the corridors sampled that

resulted in the captures reported. The echolocation signals detected were consistent with big brown as well as the Myotis species captured, but it is not possible to reliably distinguish between all Myotis species using acoustic methods. There was no indication of higher-flying species like red bat (*Lasiurus borealis*) or hoary bat (*Lasiurus cinereus*), which can readily be discriminated by their echolocation signatures.

The capture of reproductively active (pregnant and lactating) females and juvenile bats suggests that this area supports maternity roosts of some bat species during the summer months. Although big brown bats (*Eptesicus fuscus*) and little brown bats (*Myotis lucifugus*) preferentially roost in human structures such as barns and attics, particularly when forming maternity colonies (Barbour and Davis 1969), these bats can also form maternity roosts in tree cavities (Brigham 1991; Fenton and Barclay 1980).

The capture of only adult male long-eared bats (*Myotis septentrionalis)*, which are tree-roosting species (Barbour and Davis 1969), provides additional evidence for the existence of roost sites in the area surveyed, but not maternity colonies of females and young. While little brown bats tend to forage along the edges of wooded areas, northern long-eared bats are known to forage in more cluttered forested areas, below the canopy but above the understory shrub layer (LaVal *et al.* 1977). Both little brown bat and big brown bat have been shown to forage preferentially in riparian areas (Kurta 1982), as have endangered Indiana bat (Murray and Kurta 2004). The absence of significant bodies of water on this property, and the low level of bat activity detected over the ponds present on the property, suggests that even resident bats might seek other areas over which to forage.

The primary objective of this survey was to determine the extent of Indiana bat (*Myotis sodalis*) activity in this area, with particular attention to summer habitat for roosting and reproduction. Despite suitable habitat for both roosting and

foraging, the Indiana bat (*Myotis sodalis*) was not captured during this survey. While we might expect capture rates of Indiana bat to be low, as other studies (e.g., Callahan *et al.* 1997; Kurta *et al.* 1996) have shown that the bats roost singly or in small groups in hollow trees or underneath loose bark during the summer, there was potential for capture of Indiana bat moving through the habitat if these bats were present in any reasonable number, as would be expected of resident bats.

The members of a maternity colony of Indiana bat typically roost in 10 to 20 trees each summer (Callahan *et al.* 1997; Kurta *et al.* 1996). Although some colonies restrict roosting to an area of only a few acres, other Indiana bat use trees that are up to 5 miles (8 km) apart (Kurta *et al.* 1996). Radio-tracking studies of Indiana bat (Murray and Kurta 2004) show that these bats do not fly over open fields but travel along wooded corridors, even though such behavior may increase commuting distance by over 50 percent. Given this variability, it is difficult to predict the movements of bats within any one colony, but the failure to capture any Indiana bat, despite suitable roosting and foraging areas, does not provide evidence for their presence on the site.

Based upon the failure to capture any Indian bat, the clearing of trees proposed for the development of the Bell Bend Nuclear Power Plant project appears unlikely to have a significant direct impact on the roosting or foraging activity of Indiana bat in this area. It seems likely that some of the larger blocks of forested habitat surrounding the site may provide more adequate roosting and foraging habitat for tree-roosting species, including Indiana bat. The presence of trees of the appropriate size and species in which bats might roost does not preclude the potential for roost colonies of several species of bats (see Barbour and Davis 1969). This would include big brown, little brown and northern long-eared bats captured in this study, as well as Indiana bat, despite the absence of Indiana bat captures. Development of this property should proceed with this potential in mind, by conserving candidate roost trees whenever possible and, if tree removal

is necessary, limit habitat disturbance to periods outside their breeding and active season, between November 16 and March 31, when most bats, including Indiana bat, are hibernating in caves or mines.

Butterfly Survey for Species of Special Concern

Information concerning the presence of species of special concern within a 0.5-mile radius of the project area was requested via correspondence submitted on December 21, 2007 to the Pennsylvania Department of Conservation and Natural Resources (DCNR), which has jurisdiction over rare plants, natural communities, terrestrial invertebrates, and certain geological features in Pennsylvania. DCNR replied that there were no known occurrences of plants or geological features of state concern within the project area. However, the agency listed four butterfly species of concern known to occur within the project vicinity including northern pearly-eye (*Enodia anthedon*), Baltimore checkerspot (*Euphydryas phaeton*), mulberry wing (*Poanes massasoit*), and long dash (*Polites mystic*).

The project area provides potentially suitable habitat for the four butterfly species listed above based on habitat descriptions furnished by DCNR and information researched by Normandeau Associates concerning life histories and breeding/foraging preferences of these species (Table 7). DCNR requested in a response letter that attempts be made to minimize impacts to potential habitat for these butterflies within the project area (DCNR 2008).

To determine presence or absence of the four butterfly species of concern on the BBNPP site, an entomologist familiar with these species, Daniel Bogar, conducted surveys lasting 6 hours on June 12, 2008 and 4 hours on July 18, 2008. Weather on both days was excellent for insect activity with mostly sunny skies and temperatures in the mid 80's to low 90's Fahrenheit (29-34°C), between the hours of 9:30 AM and 3:30 PM. Appropriate habitat for adult

butterflies near food plants and nectar sources was searched. A pair of 8X binoculars and a net to collect voucher specimens was used when appropriate.

In terms of survey results, no northern pearly-eye, mulberry wing, or Baltimore checkerspot butterflies were located during either of the surveys. However, one worn female long dash butterfly was collected in a transmission line right-of-way (Figure 8). Based on the condition of this specimen, the first brood of this species was almost over and more individuals might have been located if the search had been conducted 1 or 2 weeks earlier. For more details on these butterfly surveys, the report is available in its entirety in Appendix C.

In an email correspondence from entomologist Daniel Bogar, dated July 24, 2008, he indicated that two of the four original butterfly species of concern (northern pearly-eye and long dash) are no longer PNDI-tracked species due to a recent revision of the state ranks. Accordingly, no evidence of the remaining two species of concern was located on the BBNPP site. However, he indicated that a new species, black dash (*Euphyes conspicua*) was added to the list of butterfly species of special concern for Luzerne County and, as indicated in his report, he collected a pair and observed at least 8-10 more black dash butterflies at the BBNPP site (Figure 8) on July 18, 2008.

LITERATURE CITED

ASM. 2008. Guidelines for the Capture, handling, and care of mammals as approved by The American Society of Mammalogists. Prepared by the Animal Care and Use Committee. Website: http://www.mammalsociety.org/committees/commanimalcareuse/98alucguidelines.pdf, Date accessed: August 20, 2008.

Barbour, R.W. and W.H. Davis. 1969. *Bats of America*. The University Press of Kentucky, Lexington. 286 pp.

Brauning, D. 1992. *Atlas of Breeding Birds in Pennsylvania*. Scarlet Tanager, Pg 360. Univ. of Pittsburgh Press.

Brauning, D. 2007. The Year of the Peregrine. PSO Pileated. Newsletter of the Pennsylvania Society of Ornithology. Vol. 18, Number 2. June 2007.

Brigham, R.M. 1991. Flexibility in foraging and roosting behaviour by the big brown bat (*Eptesicus fuscus*). Can. J. Zool. 69:117-121.

Callahan, E.V., R.D. Drobney and R.L. Clawson. 1997. Selection of summer roosting sites by Indiana bats (*Myotis sodalist)* in Missouri. J. Mammal. 78:818-825.

CFR. 2007. Title 50, Code of Federal Regulations, Part 17, Endangered and Threatened Wildlife and Plants, 2007.

CMNH. 2008. Carnegie Museum of Natural History, 2nd Pennsylvania Breeding Bird Atlas 2004-2008. Website: http://www.carnegiemnh.org/atlas/home.htm, Date accessed: April 15, 2008.

Conant and Collins. 1998. *Peterson Field Guides: A Field Guide to Reptiles and Amphibians*. Eastern/Central North America. Third Edition. Houghton Mifflin Company. 616pp.

DCNR. 2008. Letter from Rebecca H. Bowen (Pennsylvania Department of Conservation and Natural Resources, to George Wrobel (CEG GNA Engineering), Re: Environmental Review of Bell Bend Nuclear Power Plant Site, Berwick, Luzerne County, Pennsylvania, Dated: March 24, 2008.

Ecology III. 1995. Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station: 1994 Annual Report. Prepared by Ecology III, Inc., Berwick, Pennsylvania, for PPL Susquehanna, LLC. June.

Fenton, M.B. and R.M.R. Barclay. 1980. *Myotis lucifugus*. Mammal. Sepcies 142:1-8.

Gross, D. 2004. Pennsylvania Important Bird Area #50, Susquehanna Riverlands Phase I Conservation Plan. Pennsylvania Audubon, 9pp.

Hulse, A.C., C. J. McCoy and E. J. Censky. 2001. Amphibians and Reptiles of Pennsylvania and the Northeast. Cornell University Press. 419 pp.

Kurta, A. 1982. Flight patterns of *Eptesicus fuscus* and *Myotis lucifugus* over a stream. J. Mammal. 63(2): 335-337

Kurta A., K.J. Williams and R. Mies. 1996. Ecological, behavioral, and thermal observations of a peripheral population of Indiana bats (*Myotis sodalis*).

Pp. 102-117 in Bats and forests. (R.M.R. Barclay and R.M. Brigham, eds.). Research Branch, Ministry of Forests, Province of British Columbia, Victoria, British Columbia, Canada.

LaVal, R.K., R.L. Clawson, M.L. LaVal and W. Caire. 1977. Foraging behavior and nocturnal activity patterns of Missouri bats, with emphasis on the endangered species *Myotis grisescens* and *Myotis sodalis*. J. Mammal. 58(4):592-599.

Merritt. 1987. Guide to the Mammals of Pennsylvania. Pittsburgh: University of Pittsburgh Press. 90-3. 1987.

Murray, S.W. and A. Kurta. 2004. Nocturnal activity of the endangered Indiana bat (*Myotis sodalis*). Journal of Zoology 262:197-206.

NRC. 1999. Standard Review Plans for Environmental Reviews for Nuclear Power Plants, NUREG-1555, Nuclear Regulatory Commission, October 1999.

NAI. 2008. Flora survey report for the proposed Bell Bend Nuclear Power Plant. Normandeau Associates, Inc., Stowe, Pennsylvania.

PBS. 2008. Pennsylvania Biological Survey, Mammals: Review of status in Pennsylvania, Website: http://www.altoona.psu.edu/pabs/, Date accessed: April 2, 2008.

PFBC. 2008a. 2007 List of Native Species for Purposes of 58 Pa. Code Chapter 79. Available at http://www.pabulletin.com/secure/data/vol36/36-51/2532.html Accessed April 15, 2008.

PFBC. 2008b. Pennsylvania Fish and Boat Commission, Letter from Christopher A. Urban to Rod Krich (Unistar Nuclear), Re: threatened and endangered reptiles and amphibians concerning the Bell Bend Nuclear Power Site, Berwick, Luzerne County, PA. Letter dated April 14, 2008.

PGC. 2006. Management and Biology of Black Bears in Pennsylvania: Ten Year Plan (2006-2015). Available at www.pgc.state.pa.us/pgc/lib/pgc/blackbear/pdf/bear_plan_2006.pdf Accessed April 7, 2008.

PGC. 2008a. Pennsylvania Game Commission, Threatened Species: Alegheny Woodrat, Website: http://www.pgc.state.pa.us/pgc/cwp/view.asp?a=486&q=152547, Date Accessed: April 5, 2008.

PGC. 2008b. Pennsylvania Game Commission, Threatened Species: Small-footed Myotis, Website: http://www.pgc.state.pa.us/pgc/cwp/view.asp?a=486&q=152582 , Date Accessed: September 8, 2008.

PGC. 2008c. Pennsylvania Game Commission, Threatened Species: Bald Eagle, Website: http://www.pgc.state.pa.us/pgc/cwp/view.asp?a=486&q=152498&pp=12&n=1, Date accessed: April 9, 2008.

PGC. 2008d. Pennsylvania Game Commission, Threatened Species: Osprey, Website: http://www.pgc.state.pa.us/pgc/cwp/view.asp?a=486&q=152561&pp=12&n=1, Date Accessed: April 10, 2008.

PGC. 2008e. Wildlife Notes: Wild Turkeys and Pennsylvania Turkey Hunting. http://www.pgc.state.pa.us/pgc/cwp/view.asp?a=458&q=150678&pp=12&n=1 Accessed April 11, 2008.

POHA. 2008. Pennsylvania Online Herpetological Atlas: Species Distribution Maps. http://webspace.ship.edu/tjmare/maps.htm. Accessed on April 15, 2008.

PPL. 2006. Applicant's Environmental Report SSES Operating License Renewal Stage, September 2006.

PSO. 2008. Pennsylvania Society of Ornithology. Pennsylvania Ornithological Records Committee, Official List of the Birds of Pennsylvania, Website: http://www.PABirds.org/PORC/PORCofficial_list.htm, Date accessed: April 15, 2008.

USFWS. 2004. Deer Hunting in the United States-An Analysis of Hunter Demographics. Addendum to the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Report 2001-6. Available at: http://library.fws.gov./nat_survey2001_deerhunting.dpf Accessed on April 6, 2008.

USFWS. 2008. Letter from David Densmore (United States Fish and Wildlife Service) to Rod Krich (Unistar Nuclear), Re: USFWS Project #2008-518, Federally Listed Endangered and Threatened Species for the Bell Bend Nuclear Power Plant Site, Berwick, Luzerne County, PA dated January 18, 2008.

Table 1. Birds observed or likely to occur in the vicinity of the BBNPP site. List modified after the Pennsylvania Ornithological Record Committee Official List of Birds of Pennsylvania (POS 2008). (Page 1 of 11)

Common Name	Scientific Name	Status	ECO III	ECO III (breeding)	NAI	IBA	IBA (breeding)	BBA	2nd BBA	Safe Dates	
										Begin	End
Snow Goose	*Chen caerulescens*	Regular			O	✓					
Brant	*Branta bernicla*	Regular				✓					
Canada Goose	*Branta canadensis*	Regular			X	✓	✓	X	X	5/1	7/31
Mute Swan	*Cygnus olor*	Regular								5/1	8/31
Tundra Swan	*Cygnus columbianus*	Regular				✓					
Wood Duck	*Aix sponsa*	Regular			X	✓	✓	X	X	5/1	7/31
Gadwall	*Anas strepera*	Regular				✓				6/1	7/31
American Wigeon	Anas americana	Regular			O	✓				6/1	7/31
American Black Duck	*Anas rubripes*	Regular			O	✓	✓	X		5/1	7/31
Mallard	*Anas platyrhynchos*	Regular			X	✓	✓	X	X	5/1	7/31
Blue-winged Teal	*Anas discors*	Regular				✓				6/1	7/31
Northern Shoveler	Anas clypeata	Regular				✓				6/1	7/31
Northern Pintail	*Anas acuta*	Regular				✓				6/1	7/31
Green-winged Teal	*Anas crecca*	Regular	✓		O	✓				6/1	7/31
Canvasback	*Aythya valisineria*	Regular									
Redhead	*Aythya americana*	Regular				✓				6/1	8/15
Ring-necked Duck	*Aythya collaris*	Regular			O	✓				6/1	8/15
Greater Scaup	*Aythya marila*	Regular				✓					
Lesser Scaup	*Aythya affinis*	Regular				✓					
White-winged Scoter	*Melanitta fusca*	Regular				✓					
Surf Scoter	*Melanitta perspicillala*	Regular				✓					
Black Scoter	*Melanitta nigra*	Regular				✓					
Long-tailed Duck	*Clangula hyemalis*	Regular				✓					
Bufflehead	*Bucephala albeola*	Regular				✓					
Common Merganser	*Mergus merganser*	Regular				✓	✓	X	X	6/1	8/15
Red-breasted Merganser	*Mergus serrator*	Regular				✓				6/1	8/15

Table 1. Birds observed or likely to occur in the vicinity of the BBNPP site. List modified after the Pennsylvania Ornithological Record Committee Official List of Birds of Pennsylvania (POS 2008).
(Page 2 of 11)

Common Name	Scientific Name	Status	ECO III	ECO III (breeding)	NAI	IBA	IBA (breeding)	BBA	2nd BBA	Safe Dates	
										Begin	End
Ruddy Duck	*Oxyura jamaicensis*					✓				6/1	8/15
Ring-necked Pheasant	*Phasianus colchicus*	Regular			X	✓	✓	X	PO	4/15	7/31
Ruffed Grouse	*Bonasa umbellus*	Regular	✓	✓	X	✓	✓	X	PO	4/1	7/31
Wild Turkey	*Meleagris gallopavo*	Regular	✓		X	✓	✓	X	X	4/15	7/31
Northern Bobwhite	*Colinus virginianus*	Regular				✓	✓			4/15	7/31
Red-throated Loon	*Gavia stellata*	Regular				✓					
Common Loon	*Gavia immmer*	Regular				✓				6/1	7/31
Pied-billed Grebe	*Podilymbus podiceps*	Regular				✓				6/1	7/31
Horned Grebe	*Podiceps auritus*	Regular				✓					
Red-necked Grebe	*Podiceps grisegena*					✓					
Double-crested Cormorant	*Phalacrocorax auritus*	Regular			O	✓			PR	6/1	7/31
American Bittern	*Botaurus lentiginosus*	Regular				✓				6/1	7/31
Least Bittern	*Ixobrychus exilis*	Regular				✓				6/1	7/31
Great Blue Heron	*Ardea herodias*	Regular			O	✓			PO	6/1	7/15
Great Egret	*Ardea albua*	Regular	✓			✓				6/1	6/30
Snowy Egret	*Egretta thula*	Regular				✓				6/1	6/30
Little Blue Heron	*Egretta caerulea*	Regular				✓					
Cattle Egret	*Bubulcus ibis*	Regular				✓				6/1	6/30
Green Heron	*Butorides virescens*	Regular			X	✓	✓	X	PO	6/1	7/15
Black-crowned Night Heron	*Nycticorax nycticorax*	Regular								6/1	6/30
Glossy Ibis	*Plegadis falcinellus*	Regular				✓				6/1	6/30
Black Vulture	*Coragyps atratus*	Regular			X	✓			PO	5/1	7/31
Turkey Vulture	*Cathartes aura*	Regular			X	✓	✓	PO	PO	5/1	7/31
Osprey	*Pandion haliaetus*	Regular	✓			✓			O	6/1	7/31
Mississippi Kite	*Ictinia mississippiensis*	Casual				✓					
Bald Eagle	*Haliaeetus leucocephalus*	Regular	✓			✓			PO	5/1	7/15

Table 1. Birds observed or likely to occur in the vicinity of the BBNPP site. List modified after the Pennsylvania Ornithological Record Committee Official List of Birds of Pennsylvania (POS 2008). (Page 3 of 11)

Common Name	Scientific Name	Status	ECO III	ECO III (breeding)	NAI	IBA	IBA (breeding)	BBA	2nd BBA	Safe Dates	
										Begin	End
Northern Harrier	*Circus cyaneus*	Regular			O	✓				6/1	7/31
Sharp-shinned Hawk	*Accipiter striatus*	Regular	✓		O	✓	✓	PR	PO	6/1	7/31
Cooper's Hawk	*Accipiter cooperii*	Regular	✓		O	✓	✓	PR	PO	6/1	7/31
Northern Goshawk	*Accipiter gentilis*	Regular				✓				5/1	7/31
Red-shouldered Hawk	*Buteo lineatus*	Regular			X	✓	✓		PO	5/1	8/15
Broad-winged Hawk	*Buteo platypterus*	Regular	✓		X	✓	✓	X	PO	6/1	7/31
Swainson's Hawk	*Buteo swainsoni*	Accidental				✓					
Red-tailed Hawk	*Buteo jamaicensis*	Regular	✓	✓	X	✓	✓	X	PO	5/1	7/15
Rough-legged Hawk	*Buteo lagopus*	Regular				✓					
Golden Eagle	*Aquila chrysaetos*	Regular				✓					
American Kestrel	*Falco sparverius*	Regular			X	✓	✓	X	PO	5/15	7/31
Merlin	*Falco columbarius*	Regular				✓					
Peregrine Falcon	*Falco peregrinus*	Regular	✓		O	✓	✓		X	5/15	7/31
Virginia Rail	*Rallus limicola*	Regular				✓	✓	X	PO	5/15	8/15
Sora	*Porzana carolina*	Regular				✓	✓	X		5/15	7/31
Common Moorhen	*Gallinula chloropus*	Regular				✓		PR		5/15	8/31
American Coot	*Fulica americana*	Regular	✓			✓				6/1	7/31
Black-bellied Plover	*Pluvialis squatarola*	Regular				✓					
Semipalmated Plover	*Charadrius semipalmatus*	Regular				✓					
Killdeer	*Charadrirrs vociferus*	Regular			X	✓	✓	X	PO	5/1	7/15
Greater Yellowlegs	*Tringa melanoleuca*	Regular				✓					
Lesser Yellowlegs	*Tringa flavipes*	Regular				✓					
Solitary Sandpiper	*Tringa solitaria*	Regular				✓					
Spotted Sandpiper	*Actitis macularia*	Regular				✓	✓	X	PO	6/1	6/30
Semipalmated Sandpiper	*Calidris pusilla*	Regular				✓					
Least Sandpiper	*Calidris minutilla*	Regular				✓					
White-rumped Sandpiper	*Calidris fuscicollis*	Regular				✓					

Table 1. **Birds observed or likely to occur in the vicinity of the BBNPP site. List modified after the Pennsylvania Ornithological Record Committee Official List of Birds of Pennsylvania (POS 2008).**
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Common Name	Scientific Name	Status	ECO III	ECO III (breeding)	NAI	IBA	IBA (breeding)	BBA	2nd BBA	Safe Dates	
										Begin	End
Pectoral Sandpiper	*Calidris melantus*	Regular				✓					
Dunlin	*Calidris alpina*	Regular				✓					
Short-billed Dowitcher	*Limnodromus griseus*	Regular				✓					
Wilson's Snipe	*Gallinago delicata*	Regular	✓			✓				5/15	7/15
American Woodcock	*Scolopax minor*	Regular			X	✓	✓	PR		4/1	7/15
Wilson's Phalarope	*Phalaropus tricolor*	Regular				✓					
Laughing Gull	*Larus atricilla*	Regular				✓					
Bonaparte's Gull	*Larus philadelphia*	Regular				✓					
Ring-billed Gull	*Larus delawarensis*	Regular			O	✓		PO		5/15	7/31
Herring Gull	*Larus argentatus*	Regular				✓				5/15	7/31
Lesser Black-backed Gull	*Larus fuscus*	Regular									
Great Black-backed Gull	*Larus marinas*	Regular				✓					
Common Tern	*Sterna hirundo*	Regular				✓				6/5	6/30
Black Tern	*Chlidonias niger*	Regular	✓			✓				6/1	7/15
Rock Pigeon	*Columba livia*	Regular			X	✓	✓	X	PO	1/1	12/31
Eurasian Collared Dove	*Streptopelia decaocto*	Casual								5/1	7/15
Mourning Dove	*Zenaida macroura*	Regular			X	✓	✓	X	X	5/1	7/15
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Regular	✓		X	✓	✓	X	PO	6/5	7/31
Yellow-billed Cuckoo	*Coccyzus americanus*	Regular	✓	✓	X	✓	✓	X	PO	6/5	7/31
Barn Owl	*Tyto alba*	Regular				✓	✓	X		5/1	8/15
Eastern Screech-Owl	*Megascops asio*	Regular	✓			✓	✓	X	PO	4/15	8/15
Great Horned Owl	*Bubo virginianus*	Regular	✓		O	✓	✓	X	PO	12/20	7/31
Snowy Owl	*Bubo scandiacus*	Regular									
Barred Owl	*Strix varia*	Regular				✓	✓		PO	1/15	7/31
Long-eared Owl	*Asio otus*	Regular				✓				5/1	8/15
Short-eared Owl	*Asio flammeus*	Regular				✓				5/1	8/15

Table 1. Birds observed or likely to occur in the vicinity of the BBNPP site. List modified after the Pennsylvania Ornithological Record Committee Official List of Birds of Pennsylvania (POS 2008). (Page 5 of 11)

Common Name	Scientific Name	Status	ECO III	ECO III (breeding)	NAI	IBA	IBA (breeding)	BBA	2nd BBA	Safe Dates	
										Begin	End
Northern Saw-whet Owl	*Aegolius acadicus*	Regular				✓				5/1	8/15
Common Nighthawk	*Chordeiles minor*	Regular	✓			✓	✓			6/5	7/31
Whip-poor-will	*Caprimulgus vociferus*	Regular				✓	✓			6/1	7/31
Chimney Swift	*Chaetura pelagica*	Regular			X	✓	✓	PR	PO	5/25	7/31
Ruby-throated Hummingbird	*Archilochus colubris*	Regular	✓	✓	O	✓	✓	X	PO	6/1	7/15
Belted Kingfisher	*Ceryle alcyon*	Regular			O	✓	✓	X	PO	4/15	7/15
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Regular				✓				5/25	7/31
Red-bellied Woodpecker	*Melanerpes carolinus*	Regular			X	✓	✓	X	X	3/15	7/31
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Regular				✓			PO	5/15	7/31
Downy Woodpecker	*Picoides pubescens*	Regular	✓	✓	X	✓	✓	X	X	3/15	7/31
Hairy Woodpecker	*Picoides villosus*	Regular	✓	✓	X	✓	✓	X	X	3/15	7/31
Northern Flicker	*Colaptes auratus*	Regular	✓	✓	X	✓	✓	X	PR	5/15	7/31
Pileated Woodpecker	*Dryocopus pileatus*	Regular	✓	✓	X	✓	✓	X	PO	3/15	7/31
Olive-sided Flycatcher	*Contopus cooperi*	Regular				✓				6/10	7/31
Eastern Wood-Pewee	*Contopus virens*	Regular	✓	✓	X	✓	✓	X	PO	6/1	7/31
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Regular	✓		O	✓				6/10	7/15
Acadian Flycatcher	*Empidonax virescens*	Regular			O	✓	✓	PR	PO	5/25	7/31
Alder Flycatcher	*Empidonax alnorum*	Regular				✓	✓	PR	PO	6/10	7/15
Willow Flycatcher	*Empidonax traillii*	Regular			X	✓	✓	X	PO	6/10	7/15
Least Flycatcher	*Empidonax minimus*	Regular				✓	✓	X	PO	6/5	7/15
Eastern Phoebe	*Sayornis phoebe*	Regular			X	✓	✓	X	PO	5/1	7/31
Great Crested Flycatcher	*Myiarchus crinitus*	Regular	✓	✓	X	✓	✓	X	X	5/25	7/31
Western Kingbird	*Tyrannus verticalis*	Casual				✓					
Eastern Kingbird	*Tyrannus tyrannus*	Regular	✓	✓	X	✓	✓	X	PO	5/25	7/15
Loggerhead Shrike	*Lanius ludovicianus*	Regular				✓				5/1	7/31
Northern Shrike	*Lanius excubitor*	Casual									

Table 1. Birds observed or likely to occur in the vicinity of the BBNPP site. List modified after the Pennsylvania Ornithological Record Committee Official List of Birds of Pennsylvania (POS 2008). (Page 6 of 11)

Common Name	Scientific Name	Status	ECO III	ECO III (breeding)	NAI	IBA	IBA (breeding)	BBA	2nd BBA	Safe Dates	
										Begin	End
White-eyed Vireo	*Vireo griseus*	Regular			X	✓	✓	PO		5/25	8/15
Yellow-throated Vireo	*Vireo flavifrons*	Regular	✓	✓	X	✓	✓	X	PR	6/1	8/15
Blue-headed Vireo	*Vireo solitarius*	Regular			O	✓	✓		PO	5/25	7/31
Warbling Vireo	*Vireo gilvus*	Regular				✓	✓	X	PO	6/1	8/15
Philadelphia Vireo	*Vireo philadelphicus*	Regular				✓					
Red-eyed Vireo	*Vireo olivaceus*	Regular	✓	✓	X	✓	✓	X	PO	6/1	7/31
Blue Jay	*Cyanocitta cristata*	Regular	✓	✓	X	✓	✓	X	PO	6/10	7/31
American Crow	*Corvus brachyrhynchos*	Regular	✓	✓	X	✓	✓	X	PO	5/1	7/31
Fish Crow	*Corvus ossifragus*	Regular	✓	✓	X	✓	✓	X	PO	5/1	7/31
Common Raven	*Corvus corax*	Regular			X	✓	✓		PO	3/1	7/15
Horned Lark	*Eremophila alpestris*	Regular				✓			X	5/1	7/31
Purple Martin	*Progne subis*	Regular			O	✓	✓	PO		5/25	6/30
Tree Swallow	*Tachycineta bicolor*	Regular			X	✓	✓	X	X	5/25	6/30
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Regular			X	✓	✓	X	PO	6/1	6/30
Bank Swallow	*Riparia riperia*	Regular			X	✓	✓	X	X	6/1	6/30
Cliff Swallow	*Petrochelidon pyrrhonota*	Regular			O	✓	✓	X		6/5	7/5
Barn Swallow	*Hirundo rustica*	Regular			O	✓	✓	X	X	5/25	6/30
Carolina Chickadee	*Poecile carolinensis*	Regular								3/15	8/15
Black-capped Chickadee	*Poecile atricapillus*	Regular	✓	✓	X	✓	✓	X	X	4/15	8/15
Tufted Titmouse	*Baeolophrus bicolor*	Regular	✓	✓	X	✓	✓	X	X	3/15	8/15
Red-breasted Nuthatch	*Sitta canadensis*	Regular	✓	✓		✓	✓	PO		6/1	8/15
White-breasted Nuthatch	*Sitta carolinensis*	Regular	✓	✓	X	✓	✓	X	PO	5/1	8/15
Brown Creeper	*Certhia americana*	Regular	✓	✓	O	✓	✓	X	PO	5/15	7/31
Carolina Wren	*Thryothorus ludovicianus*	Regular	✓		X	✓	✓	X	X	4/1	9/30
House Wren	*Troglodytes aedon*	Regular	✓	✓	X	✓	✓	X	PO	6/1	8/15
Winter Wren	*Troglodytes troglodytes*	Regular				✓	✓		PO	5/15	8/15

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Common Name	Scientific Name	Status	ECO III	ECO III (breeding)	NAI	IBA	IBA (breeding)	BBA	2nd BBA	Safe Dates	
										Begin	End
Sedge Wren	*Cistothorus platensis*	Casual				✓				6/1	8//15
Marsh Wren	*Cistothorus palustris*	Regular				✓				5/25	7/31
Golden-crowned Kinglet	*Regulus satrapa*	Regular			O	✓	✓			5/15	8/15
Ruby-crowned Kinglet	*Regulus calendula*	Regular			O	✓					
Blue-gray Gnatcatcher	*Polioptila caerulea*	Regular	✓	✓	X	✓	✓	X	PR	5/15	7/15
Eastern Bluebird	*Sialia sialis*	Regular			X	✓	✓	X	X	5/1	8/15
Veery	*Catharus fuscescens*	Regular	✓		X	✓	✓	X	PR	6/1	7/31
Gray-cheeked Thrush	*Catharus minimus*	Regular				✓					
Swainson's Thrush	*Catharus ustulatus*	Regular				✓				6/5	7/31
Hermit Thrush	*Catharus guttatus*	Regular	✓		O	✓	✓		PO	5/15	7/31
Wood Thrush	*Hylocichla mustelina*	Regular	✓	✓	X	✓	✓	X	PO	6/1	7/31
American Robin	*Turdus migratorius*	Regular	✓	✓	X	✓	✓	X	X	5/1	7/31
Gray Catbird	*Dumetella carolinensis*	Regular	✓	✓	X	✓	✓	X	X	6/1	7/31
Northern Mockingbird	*Mimus polyglottos*	Regular			X	✓	✓	X	PO	5/15	8/31
Brown Thrasher	*Toxostoma rufum*	Regular			X	✓	✓	PR	PO	5/15	7/31
European Starling	*Sturnus vulgaris*	Regular			X	✓	✓	X	PR	4/15	7/31
American Pipit	*Anthus rubescens*	Regular				✓					
Cedar Waxwing	*Bombycilla cedrorum*	Regular	✓	✓	O	✓	✓	X	PO	6/15	7/31
Blue-winged Warbler	*Vermivora pinus*	Regular			X	✓	✓			5/25	7/15
Golden-winged Warbler	*Vermivora chrysoptera*	Regular				✓	✓	PO		5/25	7/15
Tennessee Warbler	*Vermivora peregrina*	Regular				✓					
Orange-crowned Warbler	*Vermivora celata*	Regular				✓					
Nashville Warbler	*Vermivora ruficapilla*	Regular				✓				5/25	7/31
Northern Parula	*Parula americana*	Regular			O	✓	✓	X	PO	5/25	7/31
Yellow Warbler	*Dendroica petechia*	Regular	✓	✓	X	✓	✓	X	PR	5/25	6/30
Chestnut-sided Warbler	*Dendroica pensylvanica*	Regular	✓	✓	X	✓	✓	X	PO	6/1	7/31
Magnolia Warbler	*Dendroica magnolia*	Regular				✓	✓			6/1	7/31

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Common Name	Scientific Name	Status	ECO III	ECO III (breeding)	NAI	IBA	IBA (breeding)	BBA	2nd BBA	Safe Dates	
										Begin	End
Cape May Warbler	*Dendroica tigrina*	Regular			O	✓					
Black-throated Blue Warbler	*Dendroica caerulescens*	Regular				✓	✓		PO	6/1	7/31
Yellow-rumped Warbler	*Dendroica coronata*	Regular			O	✓	✓			6/1	8/15
Black-throated Green Warbler	*Dendroica virens*	Regular	✓	✓	O	✓	✓	PR	PO	6/1	7/31
Blackburnian Warbler	*Dendroica fusca*	Regular	✓	✓		✓	✓	PR	PO	6/1	7/31
Yellow-throated Warbler	*Dendroica dominica*	Regular				✓				5/1	7/15
Pine Warbler	*Dendroica pinus*	Regular	✓	✓		✓	✓	X		5/1	8/15
Prairie Warbler	*Dendroica discolor*	Regular			X	✓	✓	X	PO	5/25	7/31
Palm Warbler	*Dendroica palmarum*	Regular			O	✓					
Bay-breasted Warbler	*Dendroica castanea*	Regular				✓					
Blackpoll Warbler	*Dendroica striata*	Regular				✓				6/15	8/15
Cerulean Warbler	*Dendroica cerulea*	Regular				✓				6/1	7/31
Black-and-white Warbler	*Mniotilta varia*	Regular	✓	✓	X	✓	✓	PR	PO	6/1	7/31
American Redstart	*Setophaga ruticilla*	Regular	✓	✓	X	✓	✓	X	PR	6/1	7/31
Prothonotary Warbler	*Protonotaria citrea*	Regular				✓				5/25	7/15
Worm-eating Warbler	*Helmitheros vermivorus*	Regular	✓	✓		✓	✓	X		5/25	7/15
Ovenbird	*Seiurus aurocapilla*	Regular	✓	✓	X	✓	✓	X	PO	6/1	7/31
Northern Waterthrush	*Seiurus noveboracensis*	Regular			O	✓		PR		6/5	7/15
Louisiana Waterthrush	*Seiurus motacilla*	Regular				✓	✓	PR	PO	4/15	7/15
Kentucky Warbler	*Oporornis formosus*	Regular	✓	✓		✓	✓	X		5/25	7/31
Connecticut Warbler	*Oporornis agilis*	Regular				✓					
Mourning Warbler	*Oporornis philadelphia*	Regular			O	✓	✓			6/15	7/31
Common Yellowthroat	*Geothlypis trichas*	Regular	✓	✓	X	✓	✓	X	PR	5/25	7/31
Hooded Warbler	*Wilsonia citrina*	Regular	✓	✓	X	✓	✓	X		6/1	7/31
Wilson's Warbler	*Wilsonia pusilla*	Regular				✓					
Canada Warbler	*Wilsonia canadensis*	Regular				✓	✓	X	PO	6/1	7/31

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Common Name	Scientific Name	Status	ECO III	ECO III (breeding)	NAI	IBA	IBA (breeding)	BBA	2nd BBA	Safe Dates	
										Begin	End
Yellow-breasted Chat	*Icteria virens*	Regular			X	✓	✓	X		6/1	7/31
Summer Tanager	*Piranga rubra*	Regular				✓				6/1	7/31
Scarlet Tanager	*Piranga olivacea*	Regular	✓	✓	X	✓	✓	X	PR	6/1	7/31
Eastern Towhee	*Pipilo erythrophthalmus*	Regular	✓	✓	X	✓	✓	X	PO	6/1	7/31
American Tree Sparrow	*Spizella arborea*	Regular			O	✓					
Chipping Sparrow	*Spizella passerina*	Regular	✓		X	✓	✓	X	PR	6/1	8/15
Field Sparrow	*Spizella pusilla*	Regular			X	✓	✓	X	PO	5/15	8/15
Vesper Sparrow	*Pooecetes gramineus*	Regular			O	✓	✓	PR	PO	5/15	8/15
Savannah Sparrow	*Passerculus sandwichensis*	Regular				✓	✓	PR	PO	5/25	8/15
Grasshopper Sparrow	*Ammodramus savannarum*	Regular				✓	✓	PO	PO	6/1	8/15
Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*	Regular				✓					
Fox Sparrow	*Passerella iliaca*	Regular			O	✓					
Song Sparrow	*Melospiza melodia*	Regular			X	✓	✓	X	X	5/15	8/15
Lincoln's Sparrow	*Melospiza lincolnii*	Regular				✓					
Swamp Sparrow	*Melospiza georgiana*	Regular			X	✓	✓	X	X	6/1	8/15
White-throated Sparrow	*Zonotrichia albicollis*	Regular			PO	✓				6/10	8/15
White-crowned Sparrow	*Zonotrichia leucophrys*	Regular			O	✓					
Dark-eyed Junco	*Junco hyemalis*	Regular			O	✓	✓		PO	5/25	8/15
Lapland Longspur	*Calcarius lapponicus*	Regular				✓					
Snow Bunting	*Plectrophenax nivalis*	Regular				✓					
Northern Cardinal	*Cardinalis cardinalis*	Regular	✓	✓	X	✓	✓	X	PR	3/15	9/30
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Regular	✓	✓	X	✓	✓	X	PO	6/1	7/31
Blue Grosbeak	*Passerina caerulea*	Regular				✓				6/1	7/31
Indigo Bunting	*Passerina cyanea*	Regular	✓	✓	X	✓	✓	X	PO	6/1	7/31

Table 1. Birds observed or likely to occur in the vicinity of the BBNPP site. List modified after the Pennsylvania Ornithological Record Committee Official List of Birds of Pennsylvania (POS,2008).
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Common Name	Scientific Name	Status	ECO III	ECO III (breeding)	NAI	IBA	IBA (breeding)	BBA	2nd BBA	Safe Dates	
										Begin	End
Dickcissel	*Spiza americana*	Regular				✓				6/1	7/31
Bobolink	*Dolichonyx oryzivorus*	Regular				✓	✓	PO	PO	5/15	6/30
Red-winged Blackbird	*Agelaius phoeniceus*	Regular			X	✓	✓	X	X	4/15	6/30
Eastern Meadowlark	*Sturnella magna*	Regular			X	✓	✓	X	PO	5/15	7/31
Rusty Blackbird	*Euphagus carolinus*	Regular			O	✓					
Common Grackle	*Quiscalus quiscula*	Regular			X	✓	✓	X	X	4/15	6/30
Brown-headed Cowbird	*Molothrus ater*	Regular	✓	✓	X	✓	✓	X	PR	5/15	7/15
Orchard Oriole	*Icterus spurius*	Regular			X	✓	✓	X	X	6/1	7/31
Baltimore Oriole	*Icterus galbula*	Regular			X	✓	✓	X	PR	6/1	7/31
Pine Grosbeak	*Pinicola enucleator*	Regular				✓					
Purple Finch	*Carpodacus purpureus*	Regular			X	✓	✓		PO	5/15	7/31
House Finch	*Carpodacus mexicanus*	Regular			X	✓	✓	X	PR	4/15	7/31
Red Crossbill	*Loxia curvirostra*	Regular				✓				5/15	7/31
White-winged Crossbill	*Loxia leucoptera*	Regular				✓					
Common Redpoll	*Carduelis flammea*	Regular				✓					
Pine Siskin	*Carduelis pinus*	Regular				✓	✓			6/1	7/31
American Goldfinch	*Carduelis tristis*	Regular	✓	✓	X	✓	✓	X	PR	6/10	8/31
Evening Grosbeak	*Coccothraustes vespertinus*	Regular				✓				6/10	7/31
House Sparrow	*Passer domesticus*	Regular			O	✓	✓	X	PO	2/1	9/30
	Total # of species:		67	46	123	245	132	116	116		

Table 1. Birds observed or likely to occur in the vicinity of the BBNPP site. List modified after the Pennsylvania Ornithological Record Committee Official List of Birds of Pennsylvania (POS 2008). (Page 11 of 11)

ECO III = species accounted for in Ecology III 1994 Report
NAI = species accounted for during field observation in 2007-2008 by Normandeau Associates
IBA = species recorded in Important Bird Area #50 (Susquehanna Riverlands)
ECO III (breeding) = recorded in 1994 report as breeding in immediate area
IBA(breeding) = recorded in PPL Birds of the Susquehanna Riverlands as breeding in immediate area
BBA = Breeding Bird Atlas survey completed from 1984-1989 in sectors 52D12 and 52D14
2nd BBA = 2nd Breeding Bird Atlas survey completed from 2004-2008 in sectors 52D12 and 52D14
Safe Dates* = a time period in which birds are considered breeding
* (Safe dates defined by 2nd breeding bird atlas. http://www.carnegiemnh.org/atlas/home.htm)

Note: Two hybrid species of the Blue-winged Warbler and Golden-winged Warbler were excluded from the list. They are the Brewster's Warbler and Lawrence's Warbler

Key for NAI, BBA, and 2nd BBA
X = confirmed breeding activity
PO = species breeding possible
PR = species breeding probable
O = species observed outside safe dates or not in appropriate habitat

Table 2. Seasonal and annual abundance and percent of field days each bird species was observed at the BBNPP site, October 2007 through August 2008.
(Page 1 of 4)

	SEASONS												Totals		
	Winter (Dec 1-Feb 28)			Spring (Mar 1- May 31)			Summer (Jun 1- Aug 31)			Fall (Sept 1-Nov 30)					
	7 days of observation			12 days of observation			12 days of observation			10 days of observation			41 days of observation		
Species	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs
Acadian Flycatcher	0	0	0.0%	1	1	8.3%	0	0	0.0%	0	0	0.0%	1	1	2.44%
American Black Duck	35	6	85.7%	17	2	16.7%	0	0	0.0%	0	0	0.0%	52	8	19.51%
American Crow	131	7	100.0%	222	12	100.0%	113	12	100.0%	98	9	90.0%	564	40	97.56%
American Goldfinch	9	4	57.1%	22	6	50.0%	131	12	100.0%	69	9	90.0%	231	31	75.61%
American Green-winged Teal	0	0	0.0%	12	2	16.7%	0	0	0.0%	65	7	70.0%	77	9	21.95%
American Kestrel	2	1	14.3%	7	6	50.0%	2	2	16.7%	0	0	0.0%	11	9	21.95%
American Redstart	0	0	0.0%	5	2	16.7%	1	1	8.3%	0	0	0.0%	6	3	7.32%
American Robin	28	5	71.4%	185	12	100.0%	187	12	100.0%	313	10	100.0%	713	39	95.12%
American Widgeon	0	0	0.0%	15	2	16.7%	0	0	0.0%	0	0	0.0%	15	2	4.88%
American Woodcock	0	0	0.0%	2	2	16.7%	0	0	0.0%	0	0	0.0%	2	2	4.88%
Baltimore Oriole	0	0	0.0%	30	4	33.3%	59	9	75.0%	0	0	0.0%	89	13	31.71%
Barn Swallow	0	0	0.0%	0	0	0.0%	12	2	16.7%	0	0	0.0%	12	2	4.88%
Belted Kingfisher	1	1	14.3%	0	0	0.0%	0	0	0.0%	1	1	10.0%	2	2	4.88%
Black and White Warbler	0	0	0.0%	1	1	8.3%	1	1	8.3%	0	0	0.0%	2	2	4.88%
Black Throated Green Warbler	0	0	0.0%	6	1	8.3%	0	0	0.0%	1	1	10.0%	7	2	4.88%
Black Vulture	0	0	0.0%	0	0	0.0%	1	1	8.3%	0	0	0.0%	1	1	2.44%
Black-billed Cuckoo	0	0	0.0%	4	2	16.7%	14	6	50.0%	1	1	10.0%	19	9	21.95%
Black-capped Chickadee	65	7	100.0%	80	10	83.3%	69	12	100.0%	92	10	100.0%	306	39	95.12%
Blue Jay	133	7	100.0%	169	12	100.0%	62	12	100.0%	182	10	100.0%	546	41	100.00%
Blue-gray Gnatcatcher	0	0	0.0%	0	0	0.0%	2	2	16.7%	0	0	0.0%	2	2	4.88%
Blue-headed Vireo	0	0	0.0%	0	0	0.0%	0	0	0.0%	2	2	20.0%	2	2	4.88%
Blue-winged Warbler	0	0	0.0%	1	1	8.3%	2	1	8.3%	0	0	0.0%	3	2	4.88%
Broad-winged Hawk	0	0	0.0%	0	0	0.0%	2	1	8.3%	0	0	0.0%	2	1	2.44%
Brown Creeper	0	0	0.0%	1	1	8.3%	0	0	0.0%	1	1	10.0%	2	2	4.88%
Brown Thrasher	1	1	14.3%	9	4	33.3%	7	3	25.0%	0	0	0.0%	17	8	19.51%
Brown-headed Cowbird	15	1	14.3%	47	9	75.0%	47	7	58.3%	0	0	0.0%	109	17	41.46%
Canada Goose	688	5	71.4%	679	10	83.3%	16	1	8.3%	231	5	50.0%	1614	21	51.22%
Cape May Warbler	0	0	0.0%	1	1	8.3%	0	0	0.0%	0	0	0.0%	1	1	2.44%
Carolina Wren	17	4	57.1%	12	4	33.3%	29	9	75.0%	23	10	100.0%	81	27	65.85%
Cedar Waxwing	30	4	57.1%	19	4	33.3%	5	1	8.3%	110	8	80.0%	164	17	41.46%
Chestnut Sided Warbler	0	0	0.0%	2	2	16.7%	8	4	33.3%	0	0	0.0%	10	6	14.63%
Chimney Swift	0	0	0.0%	0	0	0.0%	1	1	8.3%	0	0	0.0%	1	1	2.44%

Table 2. Seasonal and annual abundance and percent of field days each bird species was observed at the BBNPP site, October 2007 through August 2008.
(Page 2 of 4)

	SEASONS														
	Winter (Dec 1-Feb 28)			Spring (Mar 1- May 31)			Summer (Jun 1- Aug 31)			Fall (Sept 1-Nov 30)			Total		
	7 days of observation			12 days of observation			12 days of observation			10 days of observation			41 days of observation		
Species	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs
Chipping Sparrow	0	0	0.0%	5	2	16.7%	19	7	58.3%	0	0	0.0%	24	9	21.95%
Cliff Swallow	0	0	0.0%	0	0	0.0%	1	1	8.3%	0	0	0.0%	1	1	2.44%
Common Grackle	0	0	0.0%	88	7	58.3%	24	3	25.0%	77	4	40.0%	189	14	34.15%
Common Raven	1	1	14.3%	5	4	33.3%	2	2	16.7%	0	0	0.0%	8	7	17.07%
Common Yellowthroat	0	0	0.0%	74	4	33.3%	185	11	91.7%	6	2	20.0%	265	17	41.46%
Coopers Hawk	0	0	0.0%	0	0	0.0%	0	0	0.0%	4	1	10.0%	4	1	2.44%
Dark-eyed Junco	156	7	100.0%	49	5	41.7%	0	0	0.0%	77	4	40.0%	282	16	39.02%
Double-crested Cormorant	0	0	0.0%	1	1	8.3%	0	0	0.0%	0	0	0.0%	1	1	2.44%
Downy Woodpecker	22	7	100.0%	28	12	100.0%	16	7	58.3%	31	10	100.0%	97	36	87.80%
Eastern Bluebird	32	7	100.0%	41	10	83.3%	3	2	16.7%	48	8	80.0%	124	27	65.85%
Eastern Kingbird	0	0	0.0%	3	2	16.7%	4	3	25.0%	1	1	10.0%	8	6	14.63%
Eastern Meadowlark	0	0	0.0%	0	0	0.0%	2	1	8.3%	0	0	0.0%	2	1	2.44%
Eastern Phoebe	0	0	0.0%	18	5	41.7%	10	5	41.7%	7	3	30.0%	35	13	31.71%
Eastern Towhee	2	2	28.6%	36	8	66.7%	95	11	91.7%	14	8	80.0%	147	29	70.73%
Eastern Wood Pewee	0	0	0.0%	0	0	0.0%	10	7	58.3%	3	2	20.0%	13	9	21.95%
European Starling	14	2	28.6%	72	8	66.7%	52	5	41.7%	1160	9	90.0%	1298	24	58.54%
Field Sparrow	0	0	0.0%	113	10	83.3%	86	12	100.0%	7	3	30.0%	206	25	60.98%
Fish Crow	0	0	0.0%	0	0	0.0%	4	3	25.0%	2	1	10.0%	6	4	9.76%
Fox Sparrow	1	1	14.3%	13	4	33.3%	0	0	0.0%	14	4	40.0%	28	9	21.95%
Golden-crowned Kinglet	4	4	57.1%	1	1	8.3%	0	0	0.0%	15	6	60.0%	20	11	26.83%
Gray Catbird	0	0	0.0%	78	5	41.7%	289	12	100.0%	30	2	20.0%	397	19	46.34%
Great Blue Heron	1	1	14.3%	10	4	33.3%	0	0	0.0%	1	1	10.0%	12	6	14.63%
Great Crested Flycatcher	0	0	0.0%	0	0	0.0%	3	1	8.3%	0	0	0.0%	3	1	2.44%
Great Horned Owl	0	0	0.0%	0	0	0.0%	0	0	0.0%	1	1	10.0%	1	1	2.44%
Green Heron	0	0	0.0%	2	2	16.7%	2	2	16.7%	0	0	0.0%	4	4	9.76%
Hairy Woodpecker	1	1	14.3%	5	4	33.3%	9	6	50.0%	4	4	40.0%	19	15	36.59%
Hermit Thrush	1	1	14.3%	1	1	8.3%	0	0	0.0%	6	4	40.0%	8	6	14.63%
Hooded Warbler	0	0	0.0%	0	0	0.0%	1	1	8.3%	0	0	0.0%	1	1	2.44%
House Finch	25	3	42.9%	0	0	0.0%	1	1	8.3%	41	5	50.0%	67	9	21.95%
House Wren	0	0	0.0%	6	4	33.3%	8	3	25.0%	0	0	0.0%	14	7	17.07%
Indigo Bunting	0	0	0.0%	28	4	33.3%	158	12	100.0%	0	0	0.0%	186	16	39.02%
Killdeer	0	0	0.0%	11	5	41.7%	1	1	8.3%	0	0	0.0%	12	6	14.63%

Table 2. Seasonal and annual abundance and percent of field days each bird species was observed at the BBNPP site, October 2007 through August 2008.
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	SEASONS														
	Winter (Dec 1-Feb 28)			Spring (Mar 1- May 31)			Summer (Jun 1- Aug 31)			Fall (Sept 1-Nov 30)			Total		
	7 days of observation			12 days of observation			12 days of observation			10 days of observation			41 days of observation		
Species	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs
Mallard	47	6	85.7%	51	6	50.0%	7	2	16.7%	17	4	40.0%	122	18	43.90%
Mourning Dove	101	6	85.7%	58	10	83.3%	46	12	100.0%	204	10	100.0%	409	38	92.68%
Mourning Warbler	0	0	0.0%	0	0	0.0%	1	1	8.3%	0	0	0.0%	1	1	2.44%
No. Rough Winged Swallow	0	0	0.0%	0	0	0.0%	1	1	8.3%	0	0	0.0%	1	1	2.44%
Northern Cardinal	40	7	100.0%	94	12	100.0%	81	12	100.0%	33	8	80.0%	248	39	95.12%
Northern Harrier	2	2	28.6%	1	1	8.3%	0	0	0.0%	1	1	10.0%	4	4	9.76%
Northern Mockingbird	8	4	57.1%	8	5	41.7%	2	1	8.3%	5	4	40.0%	23	14	34.15%
Northern Parula	0	0	0.0%	2	1	8.3%	0	0	0.0%	0	0	0.0%	2	1	2.44%
Northern Waterthrush	0	0	0.0%	0	0	0.0%	1	1	8.3%	0	0	0.0%	1	1	2.44%
Orchard Oriole	0	0	0.0%	3	2	16.7%	7	3	25.0%	0	0	0.0%	10	5	12.20%
Ovenbird	0	0	0.0%	22	4	33.3%	30	6	50.0%	0	0	0.0%	52	10	24.39%
Palm Warbler	0	0	0.0%	0	0	0.0%	0	0	0.0%	2	2	20.0%	2	2	4.88%
Peregrine Falcon	0	0	0.0%	0	0	0.0%	0	0	0.0%	1	1	10.0%	1	1	2.44%
Pileated Woodpecker	10	4	57.1%	13	6	50.0%	11	6	50.0%	7	5	50.0%	41	21	51.22%
Prairie Warbler	0	0	0.0%	8	3	25.0%	11	4	33.3%	0	0	0.0%	19	7	17.07%
Purple Finch	0	0	0.0%	0	0	0.0%	2	2	16.7%	18	3	30.0%	20	5	12.20%
Purple Martin	0	0	0.0%	4	1	8.3%	0	0	0.0%	0	0	0.0%	4	1	2.44%
Red-bellied Woodpecker	10	5	71.4%	23	10	83.3%	6	3	25.0%	28	7	70.0%	67	25	60.98%
Red-eyed Vireo	0	0	0.0%	16	3	25.0%	46	10	83.3%	5	2	20.0%	67	15	36.59%
Red-shouldered Hawk	0	0	0.0%	0	0	0.0%	1	1	8.3%	2	1	10.0%	3	2	4.88%
Red-tailed Hawk	22	7	100.0%	45	11	91.7%	16	8	66.7%	21	9	90.0%	104	35	85.37%
Red-winged Blackbird	7	1	14.3%	154	11	91.7%	90	7	58.3%	45	2	20.0%	296	21	51.22%
Ring-billed Gull	0	0	0.0%	2	1	8.3%	1	1	8.3%	0	0	0.0%	3	2	4.88%
Ring-necked Duck	0	0	0.0%	7	2	16.7%	0	0	0.0%	0	0	0.0%	7	2	4.88%
Ring-necked Pheasant	0	0	0.0%	4	3	25.0%	1	1	8.3%	1	1	10.0%	6	5	12.20%
Rock Pigeon	15	2	28.6%	0	0	0.0%	2	1	8.3%	1	1	10.0%	18	4	9.76%
Rose Breasted Grosbeak	0	0	0.0%	8	2	16.7%	4	2	16.7%	3	2	20.0%	15	6	14.63%
Ruby-crowned Kinglet	1	1	14.3%	0	0	0.0%	0	0	0.0%	5	2	20.0%	6	3	7.32%
Ruffed Grouse	2	2	28.6%	2	2	16.7%	0	0	0.0%	0	0	0.0%	4	4	9.76%
Rusty Blackbird	0	0	0.0%	6	1	8.3%	0	0	0.0%	0	0	0.0%	6	1	2.44%
Scarlet Tanager	0	0	0.0%	11	3	25.0%	15	6	50.0%	0	0	0.0%	26	9	21.95%
Sharp-shinned Hawk	2	1	14.3%	1	1	8.3%	0	0	0.0%	5	5	50.0%	8	7	17.07%

Table 2. Seasonal and annual abundance and percent of field days each bird species was observed at the BBNPP site, October 2007 through August 2008.
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	SEASONS												Total		
	Winter (Dec 1-Feb 28)			Spring (Mar 1- May 31)			Summer (Jun 1- Aug 31)			Fall (Sept 1-Nov 30)					
	7 days of observation			12 days of observation			12 days of observation			10 days of observation			41 days of observation		
Species	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs	total # obs	# days obs	% days obs
Snow Goose	0	0	0.0%	0	0	0.0%	0	0	0.0%	1	1	10.0%	1	1	2.44%
Song Sparrow	7	3	42.9%	204	12	100.0%	214	11	91.7%	60	10	100.0%	485	36	87.80%
Swamp Sparrow	0	0	0.0%	0	0	0.0%	6	5	41.7%	0	0	0.0%	6	5	12.20%
Tree Sparrow	50	4	57.1%	55	5	41.7%	0	0	0.0%	29	2	20.0%	134	11	26.83%
Tree Swallow	0	0	0.0%	19	5	41.7%	12	6	50.0%	0	0	0.0%	31	11	26.83%
Tufted Titmouse	87	7	100.0%	122	12	100.0%	52	10	83.3%	60	10	100.0%	321	39	95.12%
Turkey Vulture	1	1	14.3%	14	5	41.7%	4	2	16.7%	3	2	20.0%	22	10	24.39%
Veery	0	0	0.0%	0	0	0.0%	12	5	41.7%	0	0	0.0%	12	5	12.20%
Vesper Sparrow	0	0	0.0%	0	0	0.0%	1	1	8.3%	0	0	0.0%	1	1	2.44%
White-breasted Nuthatch	31	6	85.7%	14	8	66.7%	15	7	58.3%	39	8	80.0%	99	29	70.73%
White-crowned sparrow	0	0	0.0%	0	0	0.0%	0	0	0.0%	17	3	30.0%	17	3	7.32%
White-eyed Vireo	0	0	0.0%	0	0	0.0%	2	2	16.7%	0	0	0.0%	2	2	4.88%
White-throated Sparrow	59	7	100.0%	33	8	66.7%	2	2	16.7%	77	8	80.0%	171	25	60.98%
Wild Turkey	35	3	42.9%	62	5	41.7%	3	1	8.3%	11	5	50.0%	111	14	34.15%
Willow Flycatcher	0	0	0.0%	0	0	0.0%	7	5	41.7%	1	1	10.0%	8	6	14.63%
Wood Duck	1	1	14.3%	45	6	50.0%	3	3	25.0%	0	0	0.0%	49	10	24.39%
Wood Thrush	0	0	0.0%	45	4	33.3%	54	9	75.0%	0	0	0.0%	99	13	31.71%
Yellow Warbler	0	0	0.0%	55	3	25.0%	97	7	58.3%	1	1	10.0%	153	11	26.83%
Yellow-bellied Flycatcher	0	0	0.0%	0	0	0.0%	0	0	0.0%	1	1	10.0%	1	1	2.44%
Yellow-billed Cuckoo	0	0	0.0%	0	0	0.0%	7	3	25.0%	0	0	0.0%	7	3	7.32%
Yellow Breasted Chat	0	0	0.0%	2	2	16.7%	2	1	8.3%	0	0	0.0%	4	3	7.32%
Yellow Rumped Warbler	1	1	14.3%	28	2	16.7%	0	0	0.0%	20	6	60.0%	49	9	21.95%
Yellow-shafted Flicker	17	6	85.7%	62	12	100.0%	27	9	75.0%	13	8	80.0%	119	35	85.37%
Yellow-throated vireo	0	0	0.0%	1	1	8.3%	3	1	8.3%	0	0	0.0%	4	2	4.88%

Table 3. Important terrestrial species at the BBNPP site.
(Page 1 of 4)

Name	Common Name	Description	Location	Rationale
		Mammals		
Myotis sodalis	Indiana Bat	Small, insectivorous mammal. Favors sites under exfoliating bark of large, often dead, trees as roosting sites and maternity dens.	Known to occur in hibernacula within 5 miles (8 km) of BBNPP site but has not been observed on site to date (8/5/08).	Federal and Pennsylvania Endangered
Myotis leibii	Eastern Small-footed Myotis	Small, insectivorous mammal. Little known about habitat requirements.	Known to occur in hibernacula within 5 miles (8 km) of BBNPP site but not observed on site to date (8/5/08).	Pennsylvania Threatened
Neotoma magister	Allegheny Woodrat	Mammalian rodent that favors caves, cliff faces, boulder piles, and talus slopes along mountain tops.	Range includes BBNPP site but suitable habitat appears to be lacking and none have ever been observed on site to date (8/5/08).	Pennsylvania Threatened
Myotis septentrionalis	Northern Myotis	Small insectivorous mammal (bat). Favors tree cavities and exfoliating tree bark for maternity roosts.	Known to occur in hibernacula within 5 miles (8 km) of BBNPP site and has been captured in bat survey	Pennsylvania Candidate Rare
Odocoileus virginianus	White-tailed Deer	Large, herbivorous mammal. Favors forest edge habitat. Game species	Observed in all terrestrial habitats at the BBNPP site and adjacent landscape.	Commercially and Recreationally Important
Ursus americanus	Black Bear	Large omnivorous mammal. Favors very dense vegetation, especially shrub-dominated wetland.	Tracks and scat located on BBNPP site.	Commercially and Recreationally Important
Microtus pennsylvanicus	Meadow Vole	Small mammalian rodent, primarily herbivorous, that provides prey base for carnivores.	Common, especially in herbaceous areas such as early-stage regeneration fields of the BBNPP site.	Ecologically Important
Peromyscus maniculatus	Deer Mouse	Small mammalian rodent, primarily insectivorous, that provides prey base for carnivores.	Common in most of the terrestrial habitats of the BBNPP site.	Ecologically Important

Table 3. Important terrestrial species at the BBNPP site.
(Page 2 of 4)

Name	Common Name	Description	Location	Rationale
Peromyscus leucopus	White-footed Mouse	Small mammalian rodent, primarily insectivorous, that provides prey base for carnivores.	Common in most of the terrestrial habitats of the BBNPP site.	Ecologically Important
		Birds		
Falco peregrinus	Peregine Falcon	Large predatory bird that specialized in feeding on other birds.	Nested along river within 2 miles (3.2 km)of the BBNPP site in 2007 and 2008 but not known to nest or perch on the proposed site itself.	Pennsylvania Endangered
Haliaeetus leucocephalus	Bald Eagle	Large, piscivorous (fish-eating) bird.	Known to nest within 10 miles (16 km) and sightings are increasingly common along adjacent areas of Susquehanna River.	Pennsylvania Threatened
Pandion haliaetus	Osprey	Large, piscivorous (fish-eating) bird.	Known to nest within 10 miles (16 km) and sightings are increasingly common along adjacent areas of Susquehanna River.	Pennsylvania Threatened
Meleagris gallopovo	Wild Turkey	Large upland game bird that fees on acorns, beechnuts, grapes, cherries, thornapples, grains, vegetation and insects.	Frequently observed in forests and fields at the BBNPP site.	Commercially and Recreationally Important
Piranga olivacea	Scarlet Tanager	Neotropical migratory bird that breeds in North America in late spring and early summer and winters in Central and South America in fall and winter. Favors large tracts of forest, especially forest with lots of dead or declining trees, for breeding territory.	Heard frequently throughout forested areas on the BBNPP site. Common in other forested areas in surrounding landscape based on previous ecological studies.	Ecologically Important

Table 3. Important terrestrial species at the BBNPP site.
(Page 3 of 4)

Name	Common Name	Description	Location	Rationale
Reptiles				
Pseudemys rubriventris	Redbelly Turtle	Turtle that feeds primarily on aquatic vegetation and algae and secondarily on crayfish, snails, fish, and tadpoles.	Known to occur in Luzerne County though none were observed at the site to date (8/5/08)	Pennsylvania Threatened
Crotalus horridus	Timber Rattlesnake	Large poisonous snake that feeds primarily on small mammals and birds. Favors rocky, mountainous terrain.	Known to occur in Luzerne County but has not been observed on site to date (8/5/08).	Pennsylvania Candidate.
Heterodon platyrhinos	Eastern Hognose Snake	Snake that favors grasslands and open forests near water and dry sandy soil where they can burrow. They feed primarily on toads and frogs.	The range of the hognose snake includes the BBNPP site but none have been observed on the site to date (8/5/08).	Pennsylvania Species of Special Concern
Amphibians				
Scaphiopus holbrookii	Eastern Spadefoot	Toad that requires temporary bodies of water for breeding. They feed primarily on worms and arthropods.	The range of the eastern spadefoot includes the BBNPP site but none have been observed on the site to date (8/5/08).	Pennsylvania Endangered
Insects				
Enodia anthedon	Northern Pearly-eye	Butterfly that feeds on dung, fungi, carrion, and sap from willows, poplars, and birch. Caterpillar hosts include various grasses.	Known to use area just east of the site, by Rt. 11, but none were observed on the site during a butterfly survey.	Pennsylvania Vulnerable
Polites mystic	Long Dash	Butterfly that feeds on nectar from flowers including common milkweed, selfheal, mountain laurel,. Caterpillar hosts are bluegrasses.	Known to use area just east of the site, by Rt. 11, and one was collected on site during a butterfly survey.	Pennsylvania Vulnerable

Table 3. Important terrestrial species at the BBNPP site.
(Page 4 of 4)

Name	Common Name	Description	Location	Rationale
Poanes massasoit	Mulberry Wing	Butterfly that feeds on flower nectar. Caterpillar host is uptight sedge.	Known to use area just east of the site, by Rt. 11, but none were observed on the site during a butterfly survey.	Pennsylvania Vulnerable
Euphydryas phoeton	Baltimore Checkerspot	Butterfly that feeds on nectar from milkweed, viburnum, and wild rose.	Known to use area just east of the site, by Rt. 11, but none were observed on the site during a butterfly survey.	Pennsylvania Vulnerable
Euphyes conspicua	Black Dash	Butterfly that feeds on nectar from buttonbush, jewelweed, and swampthistle. Caterpillar hosts are sedges.	Observed on the BBNPP site. Captured a pair and observed eight or ten more during a butterfly survey.	Pennsylvania Vulnerable

Table 4. Pennsylvania mammals observed or likely to occur in the vicinity of the BBNPP site. List modified after Pennsylvania Biological Survey, Mammal Technical Committee (PBS 2008). (Page 1 of 4)

Common Name	Scientific Name	Status	Habitat	Behavior	Observations
Marsupiala (pouched mammals)					
Didelphidae (New World Opossums)					
Virginia opossum	*Didelphis virginiana*	C	G	N,C	O
Insectivora (shrews and moles)					
Soricidae (shrews)					
masked shrew	*Sorex cinereus*	C	G	A	
long-tailed shrew	*Sorex dispar*	I	M,R		
Maryland shrew	*Sorex fontinalis*	C	G	A	
smoky shrew	*Sorex fumeus*	C	M,D,X	A	
pygmy shrew	*Sorex hoyi*	C	G	A	
water shrew	*Sorex palustris*	R,T	M,S	A	
northern short-tailed shrew	*Blarina brevicauda*	C	G	A	O
least shrew	*Cryptotis parva*	E	A,N	A	
Talpidae (moles)					
hairy-tailed mole	*Parascalops breweri*	C	G	A,Y	
eastern mole	*Scalopus aquaticus*	C	G	A,Y	
star-nosed mole	*Condylura cristata*	C	W,S	A,Y	
Chiroptera (bats)					
Vespertilionidae (plain-nosed bats)					
eastern small-footed myotis	*Myotis leibii*	T	S	H	
little brown myotis	*Myotis lucifugus*	C	L,S	H	O
northern myotis	*Myotis septentrionalis*	R	L,S	H	O
Indiana myotis	*Myotis sodalis*	E	S	H	
red bat	*Lasiurus borealis*	U	X	M	
hoary bat	*Lasiurus cinereus*	U	X	M	
seminole bat	*Lasiurus seminolus*	U	G,H		
silver-haired bat	*Lasionycteris noctivagans*	R	X	M	

Table 4. Pennsylvania mammals observed or likely to occur in the vicinity of the BBNPP site. List modified after Pennsylvania Biological Survey, Mammal Technical Committee (PBS 2008).
(Page 2 of 4)

Common Name	Scientific Name	Status	Habitat	Behavior	Observations
eastern pipistrelle	*Pipistrellus subflavus*	C	C,S	H	
big brown bat	*Eptesicus fuscus*	C	C	H	O
evening bat	*Nycticeius humeralis*	R	G,H	T,H	
Lagomorpha (rabbits and hares)					
Leporidae					
eastern cottontail	*Sylvilagus floridanus*	C	B,G	A,Y	O
Appalachian cottontail	*Sylvilagus obscurus*	A	M	A,Y	
snowshoe hare	*Lepus americanus*	A	M,C	N,Y	
Rodentia (gnawing mammals)					
Sciuridae (squirrels)					
eastern chipmunk	*Tamias striatus*	C	G	D,H	O
Woodchuck	*Marmota monax*	C	B,N,A	D,H	O
thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	I	N,A	D,H	
gray squirrel	*Sciurus carolinensis*	C	D,G	D,T	O
fox squirrel	*Sciurus niger*	R,E,C	D,A	D,T	
red squirrel	*Tamiasciurus hudsonicus*	C	D,X	D,T	O
northern flying squirrel	*Glaucomys sabrinus*	I	X,C	N,T	
southern flying squirrel	*Glaucomys volans*	C	D,X	N,T	O
Castoridae (beavers)					
Beaver	*Castor canadensis*	C	S,L	C,Y	T,S
Cridetidae (native rats, mice, and voles)					
white-footed mouse	*Peromyscus leucopus*	C	G	N	O
deer mouse	*Peromyscus maniculatus*	C	G	N	O
Allegheny woodrat	*Neotoma magister*	T	M,R	N,Y	
southern red-backed vole	*Clethrionomys gapperi*	C	X,C,R	N	
rock vole	*Microtus chrotorrhinus*	A	X,R	D,Y	
meadow vole	*Microtus pennsylvanicus*	C	N,W	A,Y	O

Table 4. Pennsylvania mammals observed or likely to occur in the vicinity of the BBNPP site. List modified after Pennsylvania Biological Survey, Mammal Technical Committee (PBS 2008). (Page 3 of 4)

Common Name	Scientific Name	Status	Habitat	Behavior	Observations
woodland vole	*Microtus pinetorum*	C	D,A	A,Y	
common muskrat	*Ondatra zibethicus*	C	W,L,S	N	O
southern bog lemming	*Synaptomys cooperi*	I	X,N,W	A,Y	
Muridae (old world rats and mice)					
Norway rat	*Rattus norvegicus*	C	H,A	N	
house mouse	*Mus musculus*	C	H,A	N	O
Zapodidae (jumping mice)					
meadow jumping mouse	*Zapus hudsonius*	C	N,A	H,N	O
woodland jumping mouse	*Napaeozapus insignis*	C	M,S	H,N,C	
Erethizontidae (new world porcupines)					
Porcupine	*Erethizon dorsatum*	C	M,X	N,Y	O
Carnivora (carnivores)					
Canidae (dogs and foxes)					
Coyote	*Canis latrans*	C	G	A	O
red fox	*Vulpes vulpes*	C	B,A	N	T,S
gray fox	*Urocyon cinereoargenteus*	C	B,D	N	O
Ursidae (bears)					
black bear	*Ursus americanus*	C	M,C,D	N	T,S
Procyonidae (raccoons)					
Raccoon	*Procyon lotor*	C	G	N,T	O
Mustelidae (weasels, skunks, and otters)					
Ermine	*Mustela erminea*	C	B,A	N	
long-tailed weasel	*Mustela frenata*	C	G	N	O
least weasel	*Mustela nivalis*	U	B,A	N	
Mink	*Mustela vison*	C	W,S	C	O
eastern spotted skunk	*Spilogale putorius*	A	R,M	D	
striped skunk	*Mephitis mephitis*	C	G	N	T

Table 4. Pennsylvania mammals observed or likely to occur in the vicinity of the BBNPP site. List modified after Pennsylvania Biological Survey, Mammal Technical Committee (PBS 2008). (Page 4 of 4)

Common Name	Scientific Name	Status	Habitat	Behavior	Observations
northern river otter	*Lutra canadensis*	A	S,L	A	
Felidae (cats)					
Bobcat	*Felis rufus*	A	M,B,R	N	T
Artiodactyla (even-toed hoofed mammals)					
Cervidae (deer)					
wapiti or elk	*Cervus elaphus*	A	G	A	
white-tailed deer	*Odocoileus virginianus*	C	G	A	O

Status:
C –Common
I – Restricted
U – Undetermined
R – Rare
A - At Risk
T – Threatened
E – Endangered

Habitats:
M - mountain woodlands
B - brush thickets, hedgerows
S - streams, rivers
N - grasslands
D - deciduous forests
A - agricultural lands, old fields
H - near humans
G - generalized habitat requirements
R - rocky areas
W - marshes
L - lakes, ponds
C - coniferous forests
X - mixed forests

Behavior:
C - crepuscular
A - active day and night
M - migratory
N - nocturnal
Y - active year-round
T - nests in tree hollows
H - hibernator
D - diurnal

Observations:
O – Observed
S – Scat
T - Tracks/Signs

Table 5. Mammal species observed, heard, or determined to be present from scats, tracks or other signs on the BBNPP site, October 2007 through September 2008.
(Page 1 of 3)

Mammal Species	Survey Dates											
	10/16/07	10/17/07	10/22/07	10/23/07	11/5/07	11/6/07	11/19/07	11/20/07	12/3/07	12/4/07	12/17/07	12/18/07
Beaver		T	T	T	T	T	T	T	T	T	T	T
Black bear	S											
Coyote	T	S		S,T	T				T	T	T	T
Eastern chipmunk	O	O	O	O								
Eastern cottontail		O			O						T	T
Eastern grey squirrel	O	O	O	O	O	O	O	O	O	O	O	O
Groundhog	T	T	T	T	T	T	T	T	T	T	T	T
Virginia Opossum		O									T	T
Raccoon	T											
Red squirrel	O		O		O							
Striped skunk								T				T
White-tailed deer	O	O	O	O	O	O	O	O	O	O	O	O

Mammal Species	Survey Dates											
	2/12/08	2/27/08	2/28/08	3/12/08	3/13/08	3/26/08	3/27/08	4/9/08	4/10/08	4/23/08	4/24/08	5/7/08
Beaver								T				
Bobcat		T										
Black bear					T							
Coyote	O	T,S	O	S	S					O		
Eastern chipmunk		O	O	O	O	O	O	O	O	O	O	O
Eastern cottontail		O		O	O	O	O	O	O	O	O	O
Eastern grey squirrel			O	O	O	O	O	O	O	O	O	O
Gray Fox												
Groundhog						O			O			
Long-tailed Weasel								O				
Virginia Opossum												
Raccoon		T										
Red Fox		T										

Table 5. Mammal species observed, heard, or determined to be present from scats, tracks or other signs on the BBNPP site, October 2007 through September 2008.
(Page 2 of 3)

Mammal Species	Survey Dates											
	2/12/08	2/27/08	2/28/08	3/12/08	3/13/08	3/26/08	3/27/08	4/9/08	4/10/08	4/23/08	4/24/08	5/7/08
Red squirrel									O			
Short tailed shrew									O			
Striped Skunk												
White-tailed deer	T	O	O	O	O	O	O	O	O	O	O	O

Mammal Species	Survey Dates											
	5/8/08	5/21/08	5/22/08	6/3/08	6/4/08	6/16/08	6/17/08	7/2/08	7/3/08	7/15/08	7/16/08	7/17/08
Beaver												
Bobcat												
Black bear												
Coyote												
Eastern chipmunk	O	O		O	O	O	O		O	O		
Eastern cottontail	O		O			O	O		O			
Eastern grey squirrel	O	O	O	O	O		O		O	O		
Gray Fox												
Groundhog			O	O		O						
Long-tailed Weasel												
Virginia Opossum			O									
Raccoon												
Red Fox												
Red squirrel			O	O								
Short tailed shrew												
Striped Skunk												
White-tailed deer	O		O	O	O	O		O	O	O		O

Table 5. Mammal species observed, heard, or determined to be present from scats, tracks or other signs on the BBNPP site, October 2007 through September 2008.
(Page 3 of 3)

	Survey Dates											
Mammal Species	**8/20/08**	**8/21/08**	**8/22/08**	**9/8/08**	**9/10/08**	**9/10/08**						
Beaver												
Bobcat												
Black bear												
Coyote	T,S											
Eastern chipmunk	O			O	O							
Eastern cottontail					O							
Eastern grey squirrel	O	O	O	O	O							
Gray Fox												
Groundhog												
Long-tailed Weasel												
Virginia Opossum												
Raccoon	S											
Red Fox												
Red squirrel					O							
Short tailed shrew												
Striped Skunk												
White-tailed deer	T	O	O	O	O							

Key to mammal and amphibian occurrence codes

O = observed

H = heard

T = tracks/signs

S = scats

Table 6. Pennsylvania reptiles and amphibians observed or likely to occur in the vicinity of the BBNPP site. Modified after Pennsylvania Fish and Boat Commission list of native, extant reptiles and amphibians (PFBC 2008). (Page 1 of 6)

Scientific Name	Common Name	Pennsylvania Status	Range includes BBNPP: (x) indicates that it does	Observed at BBNPP Site during NAI study
Lizards				
Eumeces anthracinus	northern coal skink	S		
Eumeces fasciatus	five-lined skink	A	X	
Eumeces laticeps	broadhead skink	C		
Sceloporus undulates	northern fence lizard	S		
Snakes				
Agkistrodon contortrix	northern copperhead	S	X	
Carphophis amoenus	worm snake	S	X	
Clonophis kirtlandii	Kirtland's snake	E		
Coluber constrictor constrictor	northern black racer	A	X	X
Crotalus horridus	timber rattlesnake	C	X	
Diadophis punctatus	ringneck snake	A	X	X
Elaphe alleghaniensis	eastern ratsnake	A	X	
Heterodon platirhinos	eastern hognose snake	S	X	
Lampropeltis triangulum triangulum	eastern milksnake	A	X	X

Table 6. Pennsylvania reptiles and amphibians observed or likely to occur in the vicinity of the BBNPP site. Modified after Pennsylvania Fish and Boat Commission list of native, extant reptiles and amphibians (PFBC 2008). (Page 2 of 6)

Scientific Name	Common Name	Pennsylvania Status	Range includes BBNPP: (x) indicates that it does	Observed at BBNPP Site during NAI study
Liochlorophis vernalis	smooth green snake	S	X	
Nerodia sipedon sipedon	northern water snake	A	X	X
Opheodrys aestivus	rough green snake	E		
Regina septemvittata	queen snake	S		
Sistrurus catenatus catenatus	eastern massasauga	E		
Storeria dekayi dekayi	northern brown snake	A	X	X
Storeria occipitomaculata occipitomaculata	northern redbelly snake	A	X	
Thamnophis brachystoma	shorthead garter snake	S		
Thamnophis sauritus	eastern ribbon snake	S	X	X
Thamnophis sirtalis sirtalis	eastern garter snake	A	X	X
Virginia pulchra	mountain earth snake	S		
Virginia valeriae	smooth earth snake	S		
Turtles				
Apalone mutica mutica	midland smooth softshell	X		
Apalone spinifera spinifera	eastern spiny softshell	S		

Table 6. Pennsylvania reptiles and amphibians observed or likely to occur in the vicinity of the BBNPP site. Modified after Pennsylvania Fish and Boat Commission list of native, extant reptiles and amphibians (PFBC 2008). (Page 3 of 6)

Scientific Name	Common Name	Pennsylvania Status	Range includes BBNPP: (x) indicates that it does	Observed at BBNPP Site during NAI study
Chelydra serpentina	snapping turtle	A	X	X
Chrysemys picta marginata	midland painted turtle	A		
Chrysemys picta picta	eastern painted turtle	A	X	X
Clemmys guttata	spotted turtle	S	X	
Emys blandingii	Blanding's turtle	C		
Glyptemys insculpta	wood turtle	S	X	X
Glyptemys muhlenbergii	bog turtle	E		
Graptemys geographica	map turtle	S	X	X
Kinosternon subrubrum subrubrum	eastern mud turtle	X		
Pseudemys rubriventris	red-bellied turtle	T	X	
Sternotherus odoratus	Stinkpot	A		
Terrapene carolina carolina	eastern box turtle	S	X	X
Frogs & Toads				
Acris crepitans crepitans	northern cricket frog	S	X	X
Bufo americanus americanus	eastern American toad	A	X	X

Table 6. Pennsylvania reptiles and amphibians observed or likely to occur in the vicinity of the BBNPP site. Modified after Pennsylvania Fish and Boat Commission list of native, extant reptiles and amphibians (PFBC 2008). (Page 4 of 6)

Scientific Name	Common Name	Pennsylvania Status	Range includes BBNPP: (x) indicates that it does	Observed at BBNPP Site during NAI study
Bufo fowleri	Fowler's toad	S	X	
Hyla versicolor	gray treefrog	A	X	X
Pseudacris brachyphona	mountain chorus frog	S		
Pseudacris crucifer crucifer	northern spring peeper	A	X	X
Pseudacris feriarum feriarum	upland chorus frog	S		
Pseudacris feriarum triseriata	western chorus frog	S		
Pseudacris triseriata kalmi	New Jersey chorus frog	E		
Rana catesbeiana	Bullfrog	A	X	X
Rana clamitans	green frog	A	X	X
Rana palustris	pickerel frog	A	X	X
Rana pipiens	northern leopard frog	S	X	
Rana sphenocephala	coastal plain leopard frog	E		
Rana sylvatica	wood frog	A	X	X
Scaphiopus holbrookii	eastern spadefoot	E	X	
Salamanders				
Ambystoma jeffersonianum	Jefferson salamander	S	X	
Ambystoma maculatum	spotted salamander	A	X	
Ambystoma opacum	marbled salamander	S	X	

Table 6. Pennsylvania reptiles and amphibians observed or likely to occur in the vicinity of the BBNPP site. Modified after Pennsylvania Fish and Boat Commission list of native, extant reptiles and amphibians (PFBC 2008). (Page 5 of 6)

Scientific Name	Common Name	Pennsylvania Status	Range includes BBNPP: (x) indicates that it does	Observed at BBNPP Site during NAI study
Ambystoma tigrinum	tiger salamander	X		
Aneides aeneus	green salamander	T		
Cryptobranchus alleganiensis alleganiensis	eastern hellbender	S	X	
Desmognathus fuscus	dusky salamander	A	X	X
Desmognathus monticola	seal salamander	A		
Desmognathus ochrophaeus	mountain dusky salamander	A	X	
Eurycea bislineata	northern two-lined salamander	A	X	X
Eurycea longicauda longicauda	longtail salamander	A	X	X
Gyrinophilus porphyriticus porphyriticus	spring salamander	A	X	
Hemidactylium scutatum	four-toed salamander	S	X	
Necturus maculosus	Mudpuppy	S		
Notophthalmus viridescens viridescens	eastern red-spotted newt	A	X	X
Plethodon cinereus	redback salamander	A	X	X

Table 6. Pennsylvania reptiles and amphibians observed or likely to occur in the vicinity of the BBNPP site. Modified after Pennsylvania Fish and Boat Commission list of native, extant reptiles and amphibians (PFBC 2008). (Page 6 of 6)

Scientific Name	Common Name	Pennsylvania Status	Range includes BBNPP: (x) indicates that it does	Observed at BBNPP Site during NAI study
Plethodon glutinosus	slimy salamander	A	X	X
Plethodon hoffmani	valley and ridge salamander	S		
Plethodon richmondi	ravine salamander	S		
Plethodon wehrlei	Wehrle's salamander	A		
Pseudotriton montanus montanus	eastern mud salamander	E		
Pseudotriton ruber rubber	northern red salamander	A	X	X

Legend:
A = Abundant
C = Candidate Species
E = Endangered Species
S = Species of special concern, rare, not common due to one or more of the following factors: range restriction, population decline, limited distribution, direct threats from habitat alteration, collection
T = Threatened Species
X = Extirpated, no longer occurs in PA

Table 7. Occurrence of host plants for butterfly species of concern at the BBNPP site. (Page 1 of 2)

Host plants		Northern Pearly Eye *Enodia anthedon*	Long Dash *Polites mystic*	Mulberry Wing *Poanes massasoit*	Black Dash *Euphyes conspicua*	Baltimore Checkerspot *Euphydryas phaeton*	ECO NAI	ECO III	ECO ATLAS
Asclepias syriaca	common milkweed		A			A	X		X
Aureolaria spp.	false foxglove					C			X
Betula spp.	birches	A					X	X	X
Brachyelytrum erectum	bearded shorthusk	C							X
Carex stricta	uptight sedge			C	C			X	X
Carex spp.	sedges			C	C		X	X	X
Chelone glabra	turtlehead					C		X	X
Desmodium spp.	tick trefoil		A						X
Echium vulgare	viper's bugloss								X
Erianthus spp.	plumegrass	C							
Fraxinus americana	white ash					C	X		X
Hystrix patula	bottlebrush	C							X
Kalmia latifolia	mountain laurel		A				X		X
Leersia virginica	white grass	C						X	X
Lonicera japonica	japanese honeysuckle					C	X		X
Pedicularis canadensis	common lousewort					C			X
Penstemon hirsutus	beardtongue					C			X
Plantago lanceolata	English plantain					C	X		X
Poa spp.	bluegrasses		C					X	X
Populus spp.	poplars	A					X		X
Prunella vulgaris	selfheal		A						X
Rosa spp.	rose					A	X	X	X
Salix spp.	willows	A						X	X
Uniola latifolia	broadleaf uniola	C							

Table 7. Occurrence of host plants for butterfly species of concern at the BBNPP site. Page 2 of 2)

Host plants		Northern Pearly Eye *Enodia anthedon*	Long Dash *Polites mystic*	Mulberry Wing *Poanes massasoit*	Black Dash *Euphyes conspicua*	Baltimore Checkerspot *Euphydryas phaeton*	NAI	ECO III	ATLAS
Viburnum recognitum	arrowwood					A,C	X	X	X
Cephalanthus occidentalis	buttonbush				A				X
Impatiens capensis	jewelweed				A		X	X	X
Cirsium muticum	swampthistle				A				X
Viola Fimbriatula	Northern downy violet								
Viola lanceolata	Lance leaved violet								X

A = Adult food
C = Caterpillar hosts
X = Species observations

NAI = observed 2007-2008 by Normandeau Associates
ECO III = observed 1990-2007 by Ecology III
ATLAS = documented as occurring in Luzerne County, PA in *The Vascular Flora of Pennsylvania*

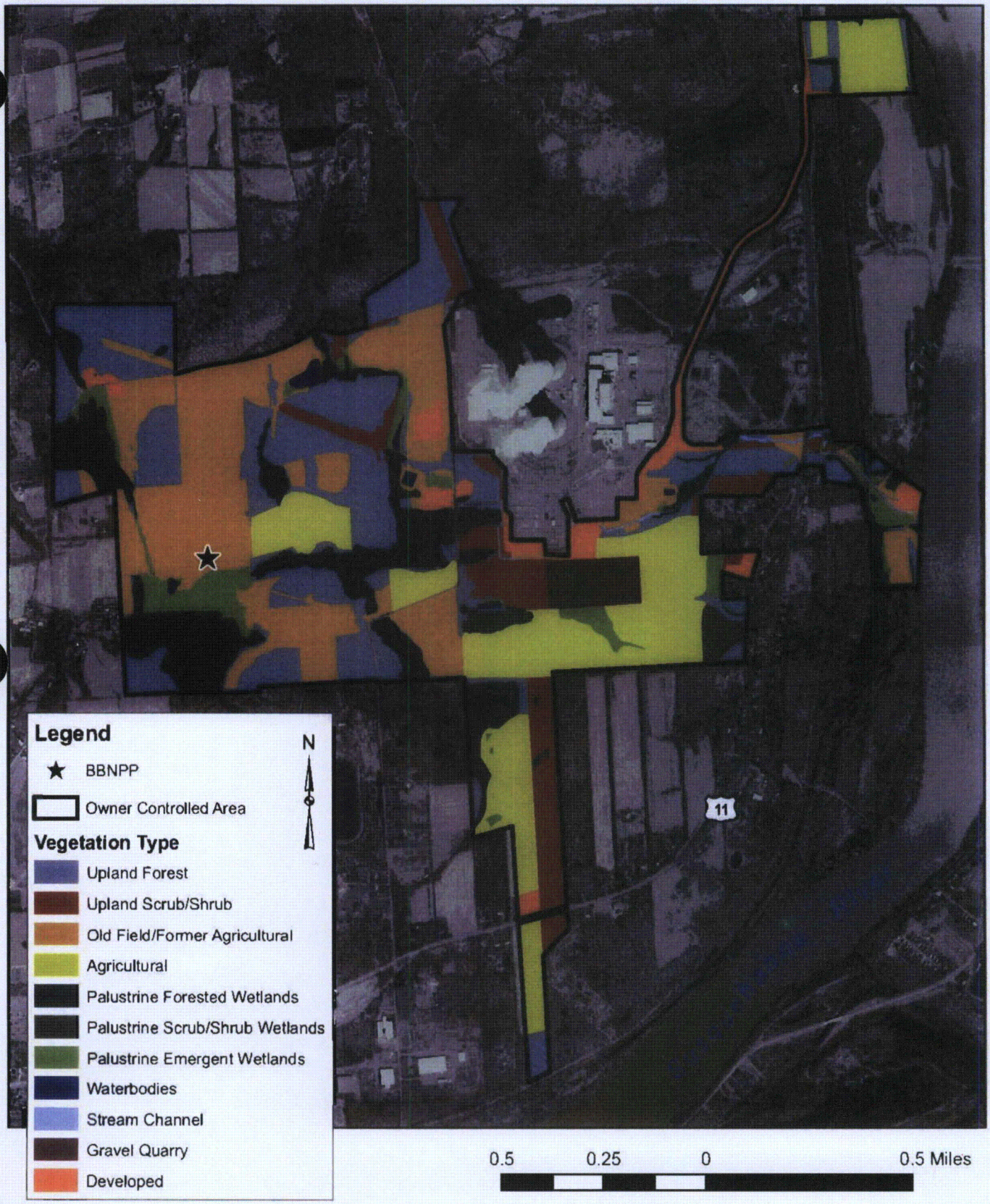

Figure 1.
Plant Communities
at the BBNPP site.

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Figure 2.
Vertebrate survey sectors and locations of mammal trap sites on the BBNPP site, May through September 2008.

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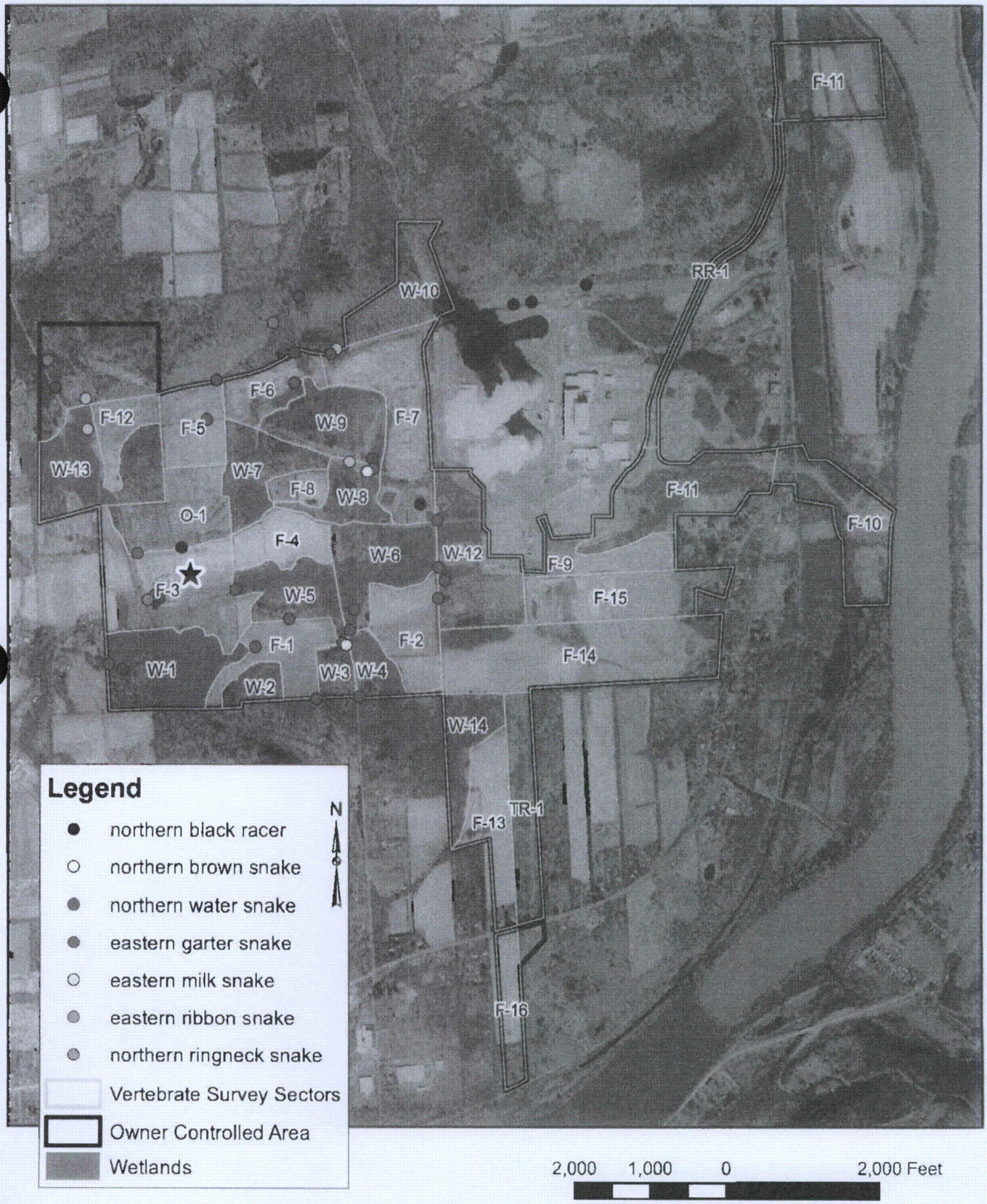

Figure 3.
Locations of observations for seven species of snakes on the BBNPP site, May through September 2008.

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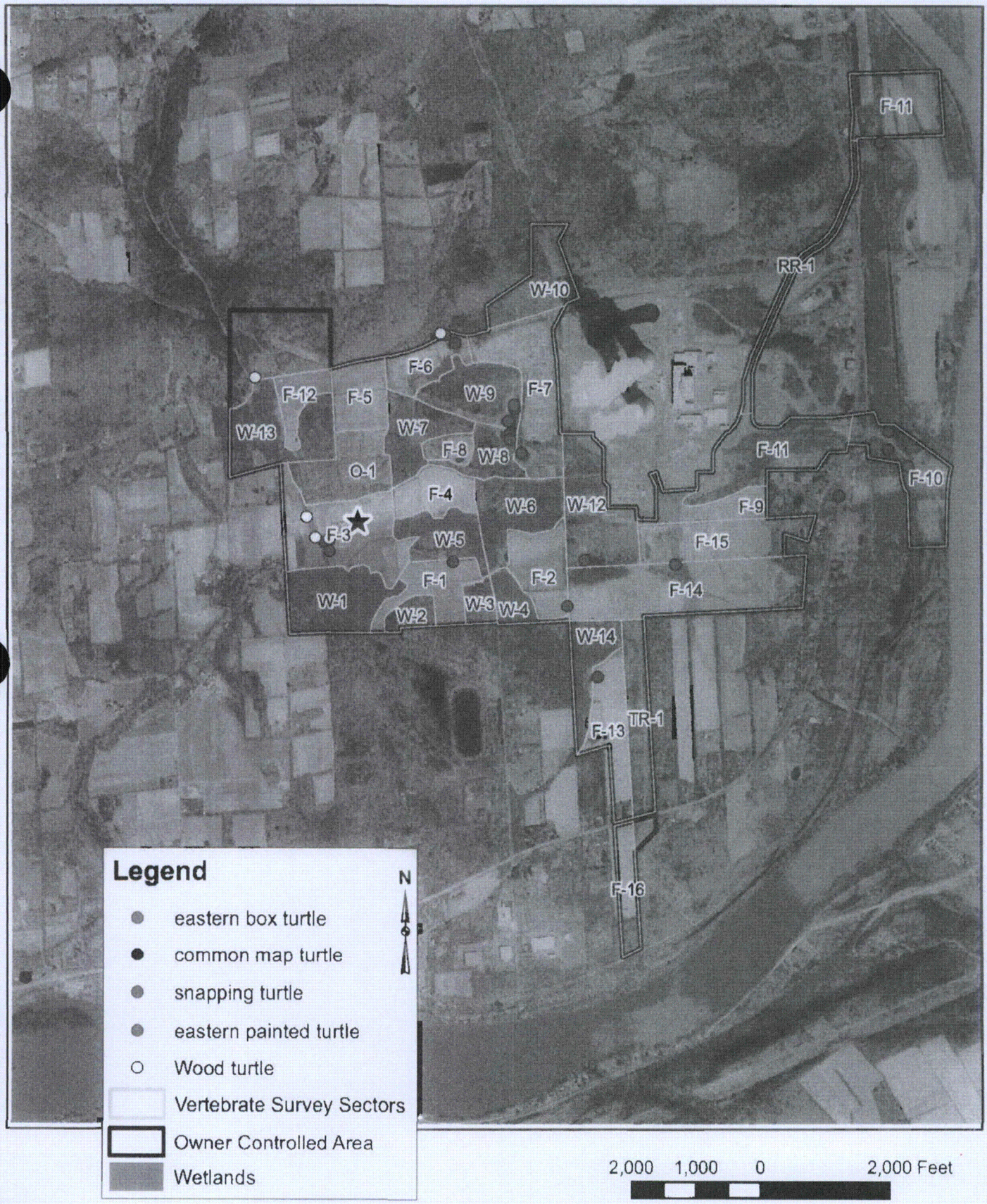

Figure 4.
Locations of observations for five species of turtles on the BBNPP site, May through September 2008.

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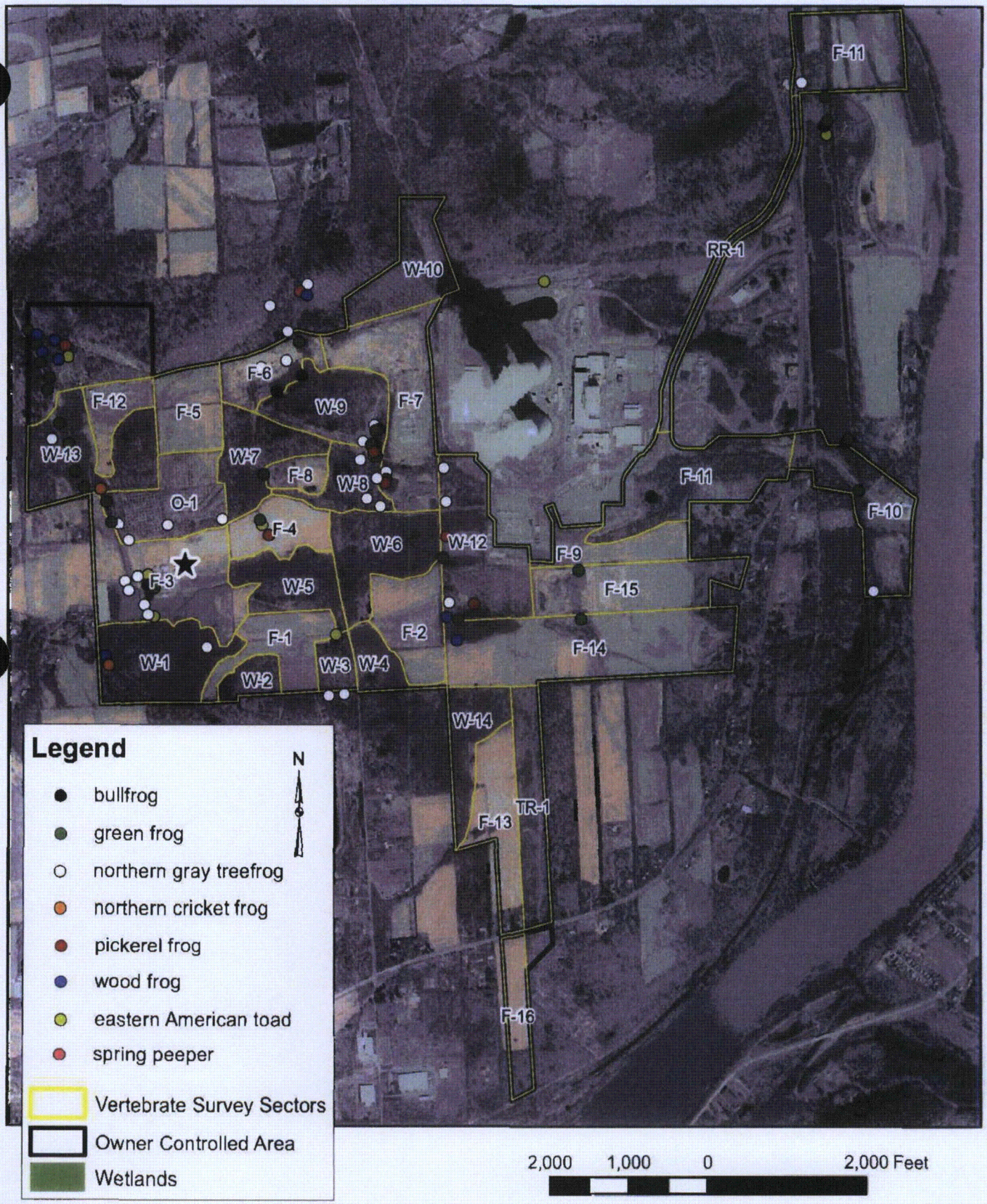

Figure 5.
Locations of observations for eight species of frogs and toads on the BBNPP site, May through September 2008.

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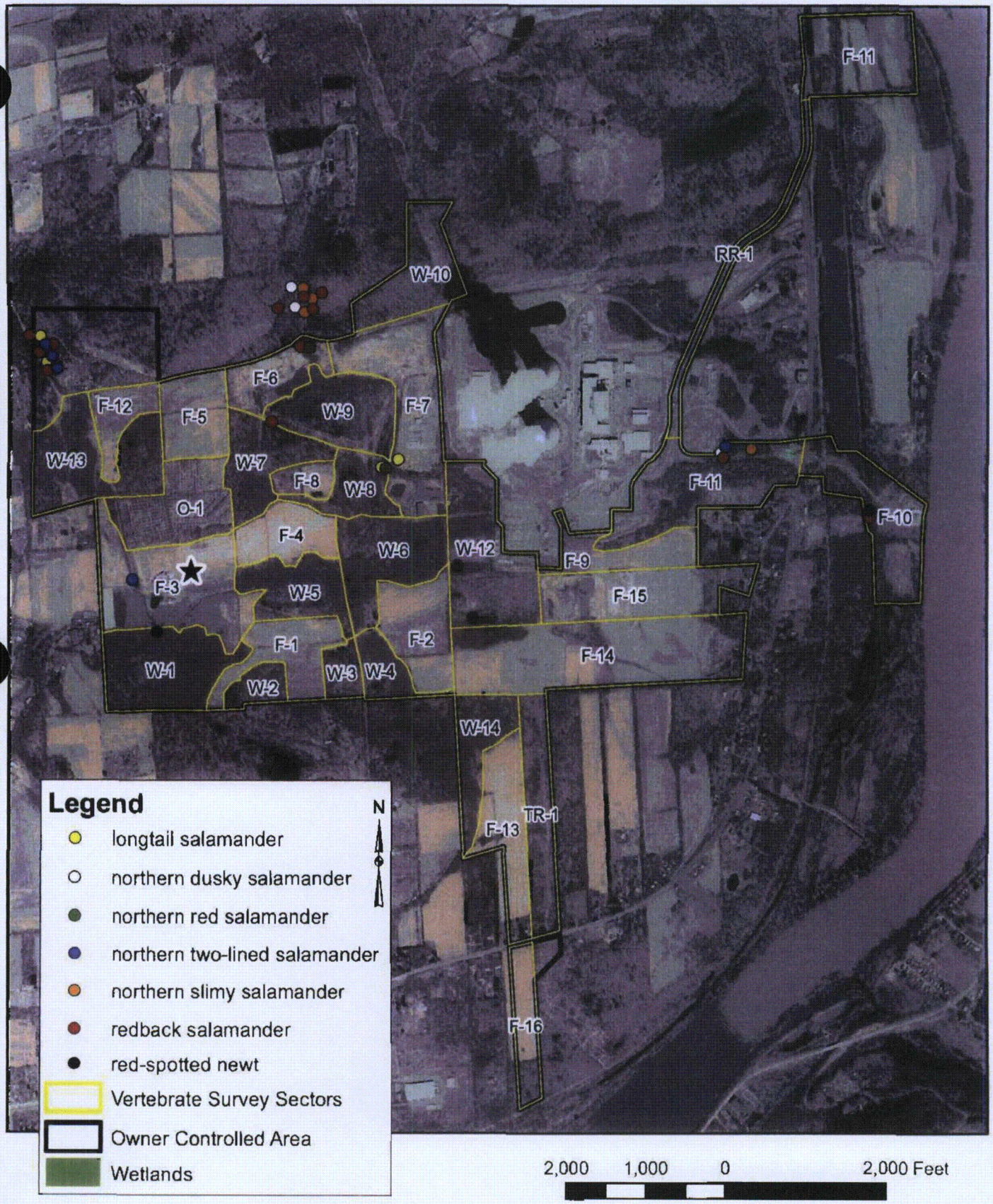

Figure 6.
Locations of observations for seven species of salamanders on the BBNPP site, May through September 2008.

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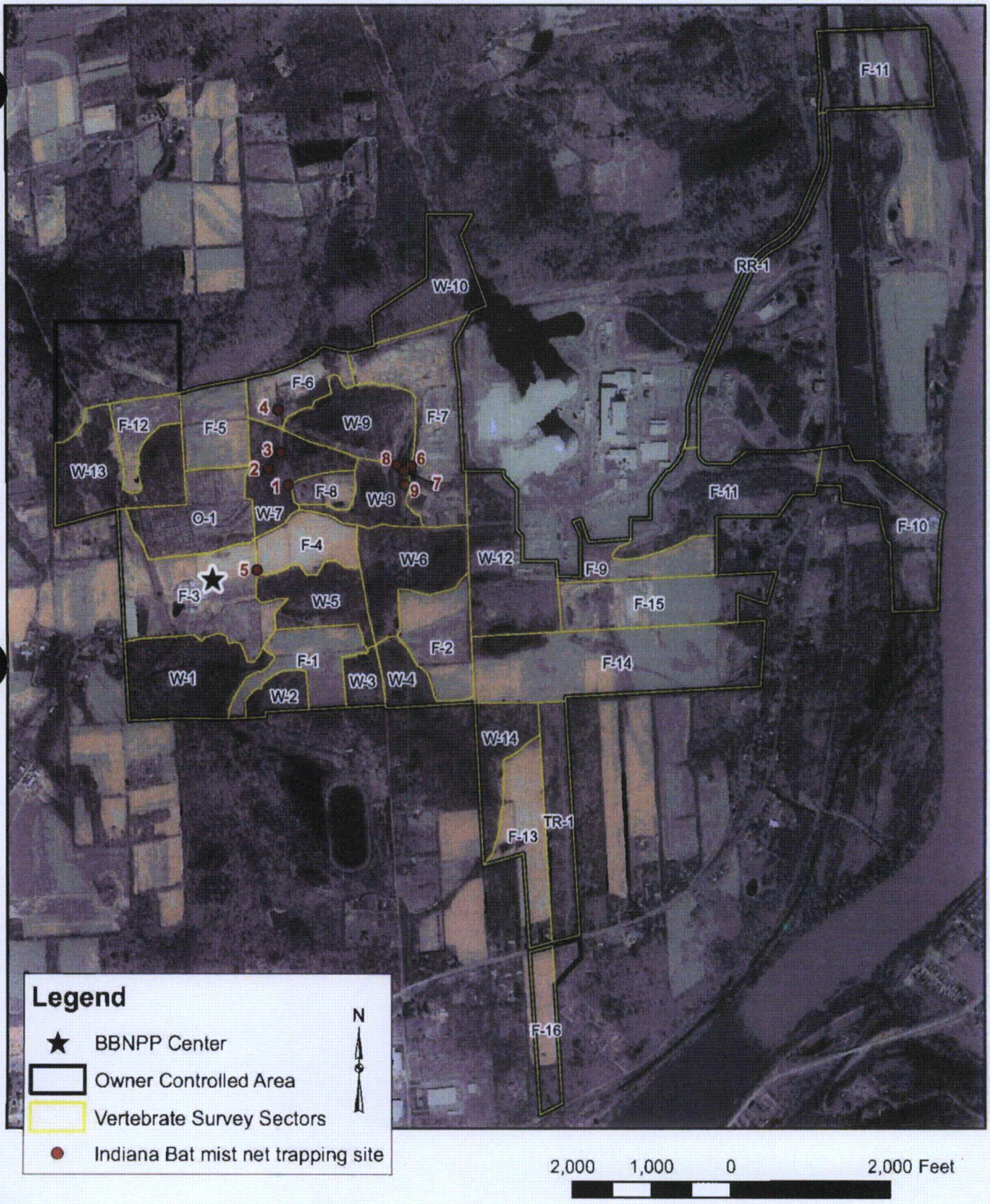

Figure 7.
Locations of mist net sites used for the Indiana Bat mist net survey at the BBNPP site, June and July 2008.

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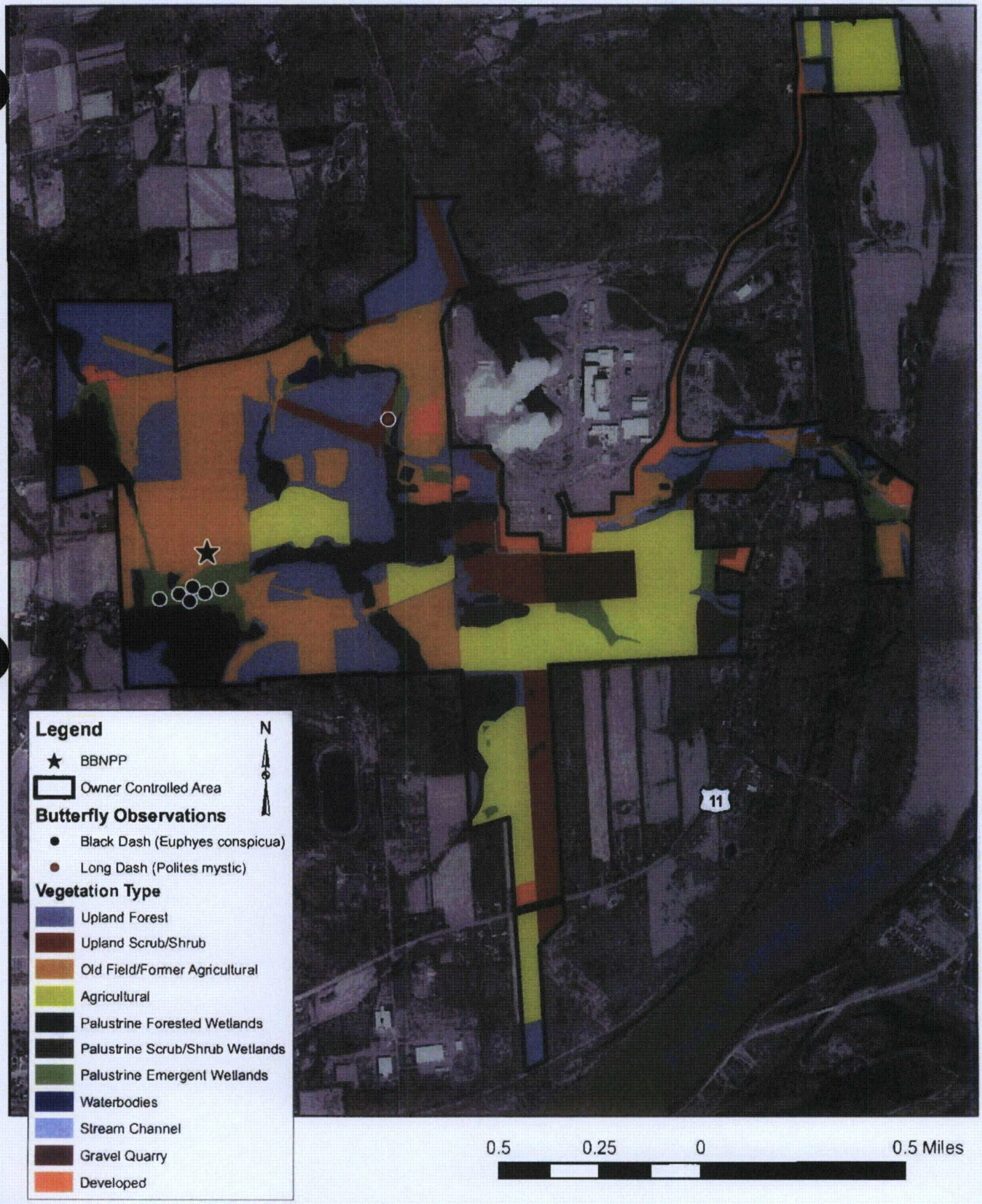

Figure 8.
Locations of observations for two butterfly species of special concern, the Long Dash (Polites mystic) and the Black Dash, (Euphyes conspicua) at the BBNPP site, June and July 2008.

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APPENDIX A

REPTILE AND AMPHIBIAN SURVEY AT THE PROPOSED BELL BEND NUCLEAR POWER PLANT SITE, LUZERNE COUNTY, PENNSYLVANIA, MAY THROUGH SEPTEMBER 2008.

By Rudolf G. Arndt, Ph.D., September 2008

INTRODUCTION

Reptile and amphibian survey work was done at the proposed Bell Bend Nuclear Power Plant (BBNPP) site, Luzerne County, Pennsylvania, between May 21 and September 7. The purpose of the survey was to determine the presence or absence, relative abundance, and distributions of amphibians and reptile species at the BBNPP site. Consideration was given to the presence of Pennsylvania-listed endangered, threatened, and species of concern, and to their habitats. A total of some 213 hours was spent in field searching on the site during eight multiple-day visits during the survey periods. This survey formed a part of a much larger survey of wetland, plant, mammal, bird, and butterfly species, and prior Amerindian and historical occupation, to identify and characterize the biological and historical history and value of the site. Some of this earlier work was done by other persons in 2007 and on other dates in 2008.

The site was divided into 33 vertebrate survey sectors, based on habitat type (forest, field, orchard, etc.) and topographical features (roads, transmission lines, stone walls, etc.) (Figure 1). The site has been continuously occupied by humans for probably about 4,000 years, first and mostly by paleolithic Indians, then by modern Indian tribes, and most recently, and for the last 200 years or so, by settlers and farmers, these last who no doubt had the greatest impact on the landscape. Historically, and recently, what maked the site attractive was the gentle topography, absence of abundant surface bedrock, and the productive soils. Thus, there is probably not a square foot of the site that has not, at one time or another, and probably frequently, been logged, clear-cut, rock-cleared, farmed, dammed, built-upon, or otherwise disturbed by humans. Evidence of human disturbance and occupation are everywhere: farm fields, fallow farm fields, secondary forest, house and barn foundations, abandoned orchards, stone fences, barbed-wire fences, farm gates, paved roads, dirt roads, man-made ponds, etc.

Nevertheless, the original habitat can still be identified. Much of the site is forested, mostly with mature deciduous forest. There are numerous wetlands of several types, including several streams, marshes, and man-made vernal and permanent ponds, much of these located in forest; and some of the streams and marshes are located in active/now inactive farmland. There is considerable wetland forest. Some forest is located on the flood-plain of the Susquehanna River. Some of the site is in fallow fields. Several larger and smaller man-made ponds, created to water former livestock or to reduce or prevent flood damage, are evident. Several areas where slate rock was quarried are present. The area assigned to be surveyed consists of well over a thousand acres.

Many additional acres were added to be surveyed near the end of this survey period as described above. Most of these latter acres are of open and scraped active quarry; of active farmland planted in corn; and of heavily man-disturbed former cropland now in the early successional stages of reverting back to forest. A rapid survey of these indicates that they are expected to contain few additional amphibian or reptile species.

Common and scientific names of species used herein follow those used in Conant and Collins (1998). On locality maps, one dot can represent one specimen, two, and in some cases, many (up to dozens).

METHODS AND MATERIALS

The survey work can be divided into six categories.

1) Most sampling was by random opportunistic searching. In this, for terrestrial reptiles and amphibians, I walked through much of the site to search for specimens and for habitat by looking for basking and foraging individuals, as well as by searching for individuals hidden in and under shelter such as logs, old boards, rocks, old sheet metal, under dead grass, by breaking open rotten logs and stumps, etc. I used the techniques appropriate to certain weather conditions and times of day to find certain species: for example, basking turtles were searched for after the early morning hours and on quiet and sun-lighted days, and frequently with the aid of binoculars. The same was true of snakes, but while a hot afternoon in June and July would be suitable to find turtles, it was often deemed to be too hot to find basking snakes, so snakes would be searched for earlier or later on such days, or on cooler days. Aquatic amphibians could be searched for on the edges of bodies of water during "nicer" weather, as well as by dip-netting in ponds and streams in all types of weather. This work basically required much walking and turning and probing and ripping (into rotting logs and stumps), and in places that corresponded to the various habitat requirements of different species.

2) In order to enhance the possibility to discover organisms that are known to seek shelter on land (which includes snakes, lizards, turtles, frogs, toads, and many species of salamanders—essentially, almost all species), I placed out in selected areas a total of 34 pieces of wood (often known as coverboards and "suckerboards") under which individuals of many reptile and amphibian species might seek shelter, whether it be from high or low temperatures, rain or sun, predators, or as sites at which to find food. These boards were examined at opportune (for the surveyor) times for what might be underneath. Since animals that might be attracted by such boards could come and go at will, such boards did not have to be examined on a specific schedule. Generally, they were examined about once every two days. The wood was of different types, mostly of plywood, and ranged in size from pieces of 8 feet by 4 feet to about 18 inches by 20 inches, and of a thickness of about 1 inch to about ½ inch. Basically, they were pieces of scrap wood that were available for the survey and which we could transport readily to the site. Boards were placed out on 4 and 5 June in seven types of habitats in areas O-1, F-1, F-3, F-6, W-3, and W-8 (Figure 1).

3) In order to sample in marshy and aquatic habitats, we constructed some 30 traps of thin-gauge screening, of which 24 were to be placed in runways or rivulets in marshes; such runways or rivulets are frequently or sometimes used by organisms as travel routes. These were deployed largely on a trial basis. Six traps were kept in reserve, in anticipation of some traps being lost or damaged. I discovered upon later and more detailed familiarity with the site that such specific types of habitat (meaning rivulets) did not occur (as it had in earlier surveys I had done), but I placed the traps out anyway. Traps were placed in marsh or ponds in areas W-8, F-7, and W-12 (Figure 1). Each trap was about 12 inches long by 5 inches wide and 4 inches high, with 1/4 inch mesh, and with a swinging door hung from the top of

each end of the trap; each door was about ½ inch higher than the trap and when set the door bottom leaned into the trap. The trap was placed where an animal might walk and push or swim through vegetation, not knowingly encounter a door, keep on moving, and, with the door so light that there was little resistance, the animal enters, and the door then swings down behind the animal. The animal cannot go forward through the door ahead, and it cannot back out or turn around to escape through the entry door, which has now swung down and closed from the inside. The trap is not baited, and is set so that the top of the trap is always above water so that an animal has access to air. This type of trap depends only on a moving animal walking into itand is easy to make, transport, set, maintain, and to empty. In previous work, with such a type of trap, which was set in bog turtle habitat, I captured organisms as diverse in size, weight, and biology, as crayfishes, frogs, turtles, and jumping mice. Traps were first placed out on June 27, and examined the last time on the morning of July 18, after which they were removed. They were examined for organism contents on the beginning and the end of each day they were out. Minor repairs, if necessary, were then also made to the traps in order to keep them functioning properly. All traps were removed at the end of each 2-4 day period on which I visited the site for field work.

4) Another method to discover reptiles and amphibians was by searching roads for live or dead individuals. Many species are known to prefer to not cross roads, but roads are not a real barrier to any species (of which I am aware) as some individuals, at least at some time or another in their life-history or life, cross roads. Many other species, however, are known to be attracted to roads, especially to take advantage of the possibility to thermoregulate(pick up warmth from the road), especially since many roads accumulate heat from the sun during the day and then release it slowly as the air cools in the evening, at night, or during a rain. Individuals of many species can simply be found much more readily when in the relative open of a road than in their normal forest or field habitats. Little-used, blacktop or similar, clean roads are the easiest to search and the most productive; heavily-used, blacktop or similar roads in very poor repair, and dirt roads, are the opposite. The roads on the site frequently traveled were of the former type. Thus, whenever I drove to the site trailer to sign in or out for the workday, or to leave the site for meals, or to move from one area of the site to another for searching activities, I always carefully observed what I might find on the roads, dead or alive. Likewise, I asked other workers on this overall project to advise me on what they might have observed on the roads and, if possible, to bring me documentation (for example, photographs, dead specimens, etc.) of this.

5) Another way to obtain data was by enlisting the help of other individuals that worked on, or were otherwise familiar with, the site. Thus, I asked other Normandeau employees (primarily Charlie Dix, Keith Maurice, Becky Smith), the site managers (Chuck Thompson, Lindsay Stutzman, Steve Finch), and site archeologists (Terry - "Butch"- Newell and his student workers), for information that they might obtain/have obtained in the routines of performing their normal tasks. All were happy to cooperate. Also consulted were local police whom I met on the site, and one long-term resident on the site. This yielded some additional data. Their hours of effort are difficult to quantify and to add to the hours of effort by the author, but their hours and contributions are significant.

6) Consulted were published books and reports and other for information on what species might occur on the site or adjacent. Particularly helpful were Conant and Collins 1998, Reptiles and amphibians of the central and eastern United States, Third Edition, Houghton Mifflin

Co., Boston. However, although such publications provided guidelines, the greatest emphasis was placed on the results of groundtruthing the site.

Unless specified otherwise, all dates given in this report refer to the year 2008.

RESULTS

A total of 27 species of amphibians and reptiles were recorded as occurring on the site, or adjacent. Fifteen species were amphibians, of which eight were toad and frog species, and seven were salamander species. Twelve species were reptiles, of which five were turtle species, and seven were snakes. These species are listed in Table 1.

All these are species that have large and what are referred to as continental distributions, and all are found in large portions of North America. Further, all are widespread throughout the northeastern United States, including large portions of Pennsylvania. None has highly specialized habitat requirements, although those with the most-specialized habitats, the longtail salamander and the northern red salamander, require cool, clean, unpolluted waters, and the common map turtle is restricted to large rivers. Some of the total group of species are extremely adaptive and have been introduced into exotic habitat or have survived the man-made alterations of their natural landscape to survive in man-altered habitat (e. g., farm ponds, man-made lakes, urban environments) within their former natural ranges where they are doing extremely well (e. g., bullfrog, green frog, snapping turtle, eastern painted turtle, eastern garter snake, northern brown snake), and at least one species (bullfrog) into areas outside of its former natural range where it is doing well and often has even become a serious pest, i.e., a competitor with native species.

Most of the 27 species usually occur in large numbers where high-quality habitat is present. Many of these species could be found in abundance on the site, especially in their early life-history stages, namely their eggs and larvae (tadpoles) (e. g., eastern American toad, northern gray treefrog, green frog, red-spotted newt, eastern painted turtle), and the adults of some species could be heard calling by the dozens (e. g., northern gray treefrog, green frog, and spring peeper, the last of which calls in the spring, before I was on the survey, but was so reported to me by a co-worker). However, most reptiles and amphibians, especially the smaller species, survive by making themselves highly inconspicuous (by which they avoid aerial and terrestrial predators, and are also in turn able to closely approach their food), so that by definition, their observed numbers are rarely large, although they most likely are indeed numerous (as based on author observations elsewhere and on published studies). Further, a few of these species (e. g., the longtail salamander and the northern red salamander) are highly secretive and occur in wetlands types in which it is usually difficult to assess their numbers.

The secretive nature of many of these species is accentuated by their usually nocturnal behavior, especially in the warmer months, and by their being most active in rainy weather (e. g., almost all the amphibians listed, as well as the eastern milk snake), or when they become almost inactive (and thus extremely difficult to find) during hot and dry weather (e. g., many of the amphibians listed, and most of the reptiles). As previously mentioned, much of the soils of the area are highly productive. This means that as the growing season progressed, the vegetation, especially of fields and marshes and wetlands, grew rampant and made effective searching for specimens extremely difficult. Some species, especially amphibians, can be found readily only during the period in which they concentrate at certain ponds for the purposes of reproduction. At this time, they may travel

relatively large distances, some coming up from underground in order to do so, and some then making themselves conspicuous by loud species-specific calls. In our region of the world, most do this in the spring, and under certain weather conditions, usually during or after heavy rains, and mostly at night. Knowing where and when a given species is likely to reproduce is very important, for otherwise their existence in a given area may not be revealed, even to the generally observant person. Actual reproduction by most such species had already occurred by the time I stated on this project. However, another Normandeau employee did spend some time searching in earlier months, during the appropriate times. Species accounts and distributions follow.

Northern cricket frog (Figure 2.) – in November 2007, Enn Kotkas heard what was apparently one individual of this species calling in Walker's Run in the West-Central portion of area W-1, and another individual at the bridge on this creek where it crosses N. Market Street near the far NW corner of Area F-3. The species is probably more common and widespread on the site.

Eastern American toad (Figure 2.) – several adults of this species, numerous tadpoles, and some recently-metamorphosed individuals were noted at several widely scattered localities on the site. Adults were seen on 6/6, 6/29, 7/16 (the last one was an old dead road-killed specimen in very poor condition), and one subadult on 9/6. Tadpoles were noted at two other localities on 6/20 and adjacent dates, and recently-metamorphosed young were noted very near the two localities at which tadpoles were seen, and on the same dates, and also on 8/21. Jayme Schaeffer mentioned seeing several adults on the site, but I do not have specific localities or dates. The species is probably widespread on the site.

Northern gray treefrog (Figure 2.) - this species was heard to call at numerous localities widely-distributed on the site as shown on the figure, and on most dates of my visit. Specific hearing dates for it were 5/29, 6/4, 6/5, 6/17, 6/19, 6/26, 6/27, 6/28, 7/14, 7/16, 7/17, 7/18, 8/19, 8/22, 9/5 and 9/6. It is tied with the green frog for having the greatest number of localities for it on the site. Several of the vernal and permanent bodies of water on the site contained its tadpoles, often in abundance. Calling adults could be heard at any time of the day or evening, and are usually most vociferous during or after rain, especially heavy rain. The incidences of its calling appeared to decrease after mid-July. Since it calls from up in trees, and usually becomes silent as a calling-site is approached, it is difficult to capture, although it is readily identified and located by its call.

Northern spring peeper (Figure 2.) - one young frog was found on 8/21 by Becky Smith, I heard several calling on 9/6, and I found one young on9/7. Enn Kotkas told me that he heard this species calling commonly throughout much of the site, mostly in lower-lying and wetter forest and also in some adjacent and more dry forest, in late October and November 2007; these records are not plotted because specific localities are not available. This is usually an early-spring breeder, when its calling, often in choruses of hundreds or thousands of frogs, makes it highly conspicuous; after breeding, the species seems to disappear.

Bullfrog (Figure 2.) – this species is moderately common at several localities on the site. Observation/hearing dates for it, all of adults, were 5/29, 6/4, 6/5, 6/6, 6/20, and 7/17. Because it is difficult to catch, and easy to confuse with the green frog at a distance, its occurrence on the site is probably underrepresented in the figure. It is widespread in North America and has been widely and unfortunately highly successfully introduced outside its natural distribution.

Green frog (Figure 2.) – this species was observed/heard at a large number of localities on the site. Specific dates of such were 5/29, 6/4, 6/5, 6/6, 6/19, 6/20, 6/26, 6/27, 6/28, 7/14, 7/16, 7/17, 8/19, 8/20, 8/21, 9/5/ and 9/7. Most of these records are of adults and of subadults, and only a few tadpoles were observed. Visually, this was the most ubiquitous amphibian and reptile on the site. The green frog occurs in meadows, marshes, woodlands, on pond, lake, and canal edges, in barren gravel pits, dirt-road pools, and generally any habitat with water, or with water nearby. It has a large distribution in eastern North America and it is usually a common species.

Pickerel frog (Figure 2.) - I have only a few records of this species from the site. Two adults were seen in a small marsh just below the "Beaver Pond" on 5/29, three just-metamorphosed individuals were seen on the edges of a (usually vernal) pond some 400 feet downstream of the previous site on 7/16 and 7/18, one adult was seen in a puddle in south-central area W-12, one adult was noted in a small pond in a corn field near the center of Area F-4 on 8/21, and one adult was noted in a marsh below the beaver dam in the northeastern part of area W-8. More search effort would probably reveal that it is more common and widely distributed on the site than is shown. It has a large distribution in North America, and is usually common in clean, clear, cool water, be it in springs, meadow streams, and woodland streams.

Wood frog (Figure 2.) - I have one record of this species from a Normandeau colleague, taken in April 2008 in Walker's Run at a point in the NW portion of area W-1, and I observed four more adults on 22 August in the SW portion of area W-12 and in the NW part of new Section No. 100, several adults in the woods along Walker's Run a short distance north of Beach Grove Road and E of Stone Church Road, and in the stream valley in the central portion of area W-10, those at the last two sites on 9/5, 9/6, and 9/7. A search for it earlier in the year would probably reveal it in much greater abundance as apparently ideal woodland habitat for it is common on the site.

Northern dusky salamander (Figure 3.) - some six specimens, all adults and subadults, were captured under rocks in a small stream in a heavily shaded glen on 7/17 and several other individuals were seen there, and about 10 adults were seen in the stream bed in mature deciduous forest in the center of section W-10 on 9/5 and 9/7. It probably occurs in other permanent and cool-water stream habitat on site. It is a widely distributed species and a usually common species in North America.

Northern two-lined salamander (Figure 3.) – this species was found as both larvae and adults. A few larvae were captured by Normandeau aquatic biologists while electrofishing in Walker's Run on the gravel by the bridge to the site trailer on 7/14, an adult was captured there on an unknown date in May or June 2008, several more were captured further upstream in this creek on 8/21 and 9/5 in the newly acquired lands, and four adults were noted on 7/17 in a clear, cool, rocky woodland stream (the ideal habitat) located just S of the main access road to the generating station from Rt. 11. It is usually very active, and thus can be difficult to capture and identify. It probably occurs in other clear, cool, stream habitat on the site. It has a large distribution in the United States and it is usually common in appropriate habitat.

Longtail salamander (Figure 3.) - one adult about 6 inches (14.0 cm) in total length was found under a log on the edge of a small marsh in NE portion of W-8 on 5/29, another adult was found nearby on 8/19 under some rubber matting inside a very large metal pipe with a bit of water inside it, and several more adults were found on 8/21 and 9/5 under stones along Walker's Run near the extreme NW corner of the site, on the newly acquired lands. This species is highly secretive, usually nocturnal, and often difficult to find.

Redback salamander (Figure 3.) – this completely terrestrial salamander is represented on site by both the red-backed and the lead-backed color phases, but only a few individuals, all adult and one sub-adult, were found, and these at widely-distributed points on the site. Capture dates were 5/22, 5/29, 6/18, 7/17, 8/21, 9/5, and 9/7. It is probably much more common on the site than is represented by the few records presented as appropriate woodland habitat is common. This species had a large distribution and it is usually common where it occurs.

Slimy salamander (Figure 3.) - I found one juvenile of this salamander under loose bark of a downed tree near a small stream in central area W-11 on 8/20, and several adults in the woods of central portion of area W-10 on 9/5 and 9/7. It is secretive and nocturnal, usually hiding under wood or stones, and is no doubt more widely distributed on the site.

Red-spotted newt (Figure 3.) – found was one land stage (red eft) immature individual on 6/18 under an old railroad tie. numerous aquatic larvae in one vernal on 6/27 and 7/16 and one red eft here on 9/7, numerous adults in one permanent pond on 7/16, and one red eft where Walker's Run enters the woods at the border of area F-3 and W-1 (summer 2008). It probably occurs in other quiet and slow waters on the site, and the red eft, which is the dispersal phase in the life-history of this species, under appropriate conditions, can be expected to be found moving overland in any wooded habitat on the site, especially after a rain. It is a species with a very wide distribution and where found it is usually common to abundant.

Northern red salamander (Figure 3.) – one adult of this species was found on 6/19, under a coverboard in the same small marsh with a long-tailed salamander in NE area W-8; another adult under a small log next to Walker's Run on 8/21, and another adult under a stone next to a tiny creek on 8/21. This species is usually secretive and occurs burrowed in or otherwise well-hidden in the substrate of clear and clean marshes and mud, and thus is difficult to find. Overall, it has a wide distribution.

Snapping turtle (Figure 4.) – several adults, subadults, and one juvenile were found at several widely-distributed points on the site: some individuals were basking on logs (1 adult and 1 subadult 5/29, 1 subadult. 6/18), some small adults were discovered in water 6/20, 7/16, 9/7, one juvenile was caught in a trap on 7/18, and one large individual was found dead on 6/18 on Route 11 approximately one mile from the SW corner of the site. I have one more record of it, of a "small" snapper, from the archeologists, and another of a female digging a nest just before 5/31 in a field, but sighting dates and places are not exact and thus cannot be mapped. The species spends most of the time in the water and, although it reaches a large size, is thus not readily seen. It is no doubt more widely distributed and common on the site than these records indicate. It is widely distributed in North and Central America, and where it occurs, it is usually common.

Eastern painted turtle (Figure 4.) - this was the most common turtle on the site and at one time and in one small man-made pond on 7/16 an estimated 200 heads of this species were seen poking out of surface duckweed; this species could be seen on every visit to Beaver Pond basking on logs and rocks; it occurred in the pond just S of the site trailer; one sub-adult was captured in a trap in a small man-made vernal pond near the West Building; the species was common in the canals and ponds in the SE portion of the site near the Susquehanna River and where some six nests were found on 6/18; one was seen in a barren moon-landscape of an active quarry just S of area F-9 (Figure 1); and one was crossing Beach Grove road near "Bullfrog Pond" in area F-6. Overall, I have dates of

observation of it from 5/29 to 9/5. This subspecies has a large range in the eastern United States, and the species is distributed from the Atlantic to the Pacific coasts of North America.

Wood turtle (Figure 4.) – at least two adults, and possibly up to four, were noted in this survey. Two, possibly three (one individual noted by RGA might have been the same individual shown to me in a cell phone photograph taken by the site manager, or it might have been another individual—the quality of the photos did not allow positive identification), were noted in and near Walker's Run in the general vicinity of the site trailer, and one (properly identified?) was noted by an archeologist to cross Beach Grove Road near "Bullfrog Pond" in area F-6 (Figure 1). Dates of observation were 6/1, 6/4, 6/25 and 6/27. In addition to the previous records, Mrs. Hummel, the landowner nearest the junction of Beach Grove Road and N. Market Street, near the NW extreme of the site, told me she saw wood turtles crossing Beach Gove Road at the Walker's Run passage there frequently over the years. This species hibernates in winter in a creek such as Walker's Run, and then forages and reproduces in adjacent woods and meadows in the warmer months. Where most of the specimens were found on the site is "classical" habitat for the species.

Common map turtle (Figure 4.) – one adult female was found dead on Route 11 about 1.5 miles from the SW corner of the site on 6/18. This river-dwelling turtle is expected only in the main-stem of the Susquehanna River, except for females, such as this one, on several days of the year, that had moved up a high and steep river embankment and then along a dirt road and then onto a highway, for a total distance from the river of at least 600 feet, in an effort to find a suitable nest site. The dead animal was large and measured 8.1 inches (20.7 cm) straight-line carapace length (and with extended head and legs it appeared even larger), and when I first noted the carcass, as I was rapidly driving by it, I believed it to be a dead snapping turtle. Only the next morning, when I drove past it again and then stopped and returned to examine it, did I discover that it was a map turtle. It contained at least seven eggs (the carcass and some eggs were smashed) that were ready to be deposited.

Eastern box turtle (Figure 4.) - four adults of this terrestrial species were found at widely-distributed parts of the site, on the dates 5/22, 6/5, 6/17, and 9/7. All were found near or on the edges of open fields, or in a field. I have one more record from the archeologists on site, but sight dates and places are inexact and thus cannot be mapped. The juveniles and sub-adults of this species are known to be very difficult to find because they are so secretive, the adults much less so, but in an area such as much of the site, with luxuriant vegetation in the mid- to late-summer, even adults can "disappear", and hot and dry weather results in it to aestivate. This is a widely-distributed species in North America. While still common in many areas, it is becoming less so as its needs conflict with the increasing human population.

Northern black racer (Figure 5.) – six adults of this species were found, at widely distributed parts of the site, all in open, grassy areas, on the dates 5/22, 6/4, 6/6,and 6/28 (two of these snakes were found on more than one date), and one dead-on-road hatchling on Beach Grove Road on 8/21. Four adults were found in proximity to each other: two of these probably hibernated near each other, two were sheltering under the same small area of patio blocks by the West Building; and two others were crossing Beach Grove Road about 200 feet apart just N of the two cooling towers and moving in the same direction. This is a common and widely-distributed snake, and still often survives in proximity to people, such as on popular barrier islands and near farm buildings. It can probably do so because it is highly alert and can readily evade humans, and because it is a generalist feeder.

Eastern milk snake (Figure 5.) – records of four live specimens of this colorful species were obtained, one a 2007 hatchling alive on Beach Grove Road on 7/16, one a 2006 hatchling under a stone on a powerline right-of-way on 6/5 (where I had been tipped off to the possible presence of a snake by finding a shed skin under that same stone a few days earlier), one adult at a farm house at the junction of Beach Grove Road and N. Market Street in summer 2007, and another adult at the edge of the latter road on 5/30. A dead-on-road young snake was found on the edge of N. Market Street and near the junction with Beach Grove Road on 9/5. The owner of a home and out-buildings here, Mrs. Hummel, described snakes she had seen here over the years, and they must have been milk snakes. This species is common in man-disturbed habitat, and especially near and in barns, foundations of occupied homes, and foundations of old and abandoned homes. These structures provide shelter and usually indicate the presence of small mammals, a major food.

Northern water snake (Figure 5.) – this is a species that I had expected more commonly on the site, given how much suitable-looking aquatic habitat is present and my efforts searching in such habitat. However, I have records of only four specimens, all adults, on the site, and by two sets of individuals and myself. One snake was seen swimming in the pond some 150 feet S of the site trailer on 6/17, one was taken by a fish-shocker in "Beaver Pond" in the SE part of area W-9 on 7/14, one was taken by such a shocker in Walker's Run in the NW corner of area W-1 on 7/14, and one was found under a rock on near Walker's Run in the newly-acquired land on 8/21. This is a widely-distributed species in much of eastern North America, is usually common, and is common in man-made and man-disturbed areas, such as ponds, lakes, dams, dykes and other retaining walls, etc., where it feeds mostly on fishes, frogs and tadpoles.

Eastern ribbon snake (Figure 5.) - one adult of this snake was reported to me seen in summer 2008 by Chuck Thompson from the pond just S of the site trailer .

Eastern garter snake (Figure 5.) – this was by far the most common and widely-distributed snake on the site, and a total of about 25 different individuals were found, some of them at the same sites repeatedly over a period of several day and doing the same things (exposed and basking or hiding under bark—I got to know some of the snakes and their behavior with predictability). The dates of capture or observation ranged from 5/22 to 9/7. Snakes ranged from young-of-year individuals born in 2008 to adults; as a group they were found basking in stone walls, hiding under rocks, under sheets of plastic, under loose bark of fallen trees, basking on fallen tree trunks, basking on rocks next to a marsh, alive on paved roads, dead on paved roads, in open sunlighted areas (fields), and in mature mesic wood habitat. This species has a large distribution in the eastern North America, and is common even in urban areas such as New York City in parks and in vacant lots, in backyards in suburbia, and in farmed areas. Its relatively small size and food of earthworms and frogs and tadpoles facilitate such lives.

Northern brown snake (Figure 5.) – four adults of this species were found on the site: one under dead grass next to a small stream in a sunlighted wetland on 5/29, two under loose stones of a stone wall within inches of an adult garter snake on the edge of Confers Lane on 6/18, and one under bark of a large dead tree in a moist field in area 100 on 8/20. The adults are about 11 inches (4.3 cm) long. This is a very widely-distributed species, and it occurs commonly in urban and suburban areas, where its small size and camouflaged coloration easily conceal it, and its food of worms and slugs is usually common. It is no doubt widespread and common on the site.

Northern ringneck snake (Figure 5.) – three adults of this species were found, both in mature mesic forest, one near the center of area W-10 among old truck inner tubes next to a paved road on 9/5, and two under adjacent stones on a forested slope on the E side of the valley of Walker's Run (in newly-acquired land) on 9/6. All were of approximately the same total length, and the one that was measured was 39 cm long.

DISCUSSION

Additional species of amphibians and reptiles can be expected to be found on the site. These include, especially, smooth green snake, *Opheodrys vernalis*; northern red-bellied snake, *Storeria o. occipitomaculata*; and black rat snake, *Elaphe o. obsoleta*. Suitable habitat for these species, and the site is well-within the distribution of all, appears to be present. Perhaps further searching will reveal them to be here. All are widely-distributed and usually common species, and none is a species of concern in Pennsylvania.

Other species that occur generally in this area of Pennsylvania include the timber rattlesnake, *Crotalus horridus*. I found no suitable habitat, such as rock ledges, rock and boulder slides, and relatively wild forested habitat, for this species on site. Further, the long agricultural and other human-occupation history of the site suggests that if the species did once occur, it has by now long been extirpated. The same comments can be made locally about the northern copperhead, *Agkistrodon contortrix mokasen*. Typically, long after such serpents have been extirpated from an area, rumors of their existence there still persist, and I have no indication of even rumors referable to the survey site.

The eastern hognose snake, *Heterodon platyrhinos*, can be expected to occur locally. No specimen was found. Usually, population density of this species in habitat as occurs on the site, if the species indeed occurs, is low. More optimal habitat for it would be areas with more sand and with a higher population of toads, which are its almost exclusive food. Because of the spectacular anti-predator behavior display of this species, with spreading neck hood, hissing, and mouth-gaping, its presence in an area is usually known by local persons, and the presence of the snake on the site would be known (probably exaggerated). So, far, such was not recorded, which makes me believe that the species is absent from the area, or highly uncommon.

According to Conant and Collins (1998), the redbelly turtle, *Pseudemys rubriventris*, does not occur this far away from south-eastern Pennsylvania, along the Delaware River, the only area in the state from which it is reliably known as occurring naturally. When adult, this turtle is large and this, along with its conspicuous basking behavior, make it relatively noticeable. No redbelly turtle was noted in this survey, nor is likely to be. If it should be found in the area, which is highly unlikely, it would be as a result of introduced (released or escaped) individuals.

The eastern spadefoot, *Scaphiopus holbrooki*, is an amphibian that occurs in a limited portion of Pennsylvania, namely in a narrow wedge, with a point in approximately central Pennsylvania, and this extending to a bit wider base to the southern state line. No evidence of it on the site was found, nor is it likely to be. According to Conant and Collins (1998), it does not occur in or near that part of Pennsylvania that includes the study site. It is an "explosive breeder" that may remain underground for years at a time, to rise to the surface after a major rain event in summer, to reproduce, feed for a few days, and then return underground.

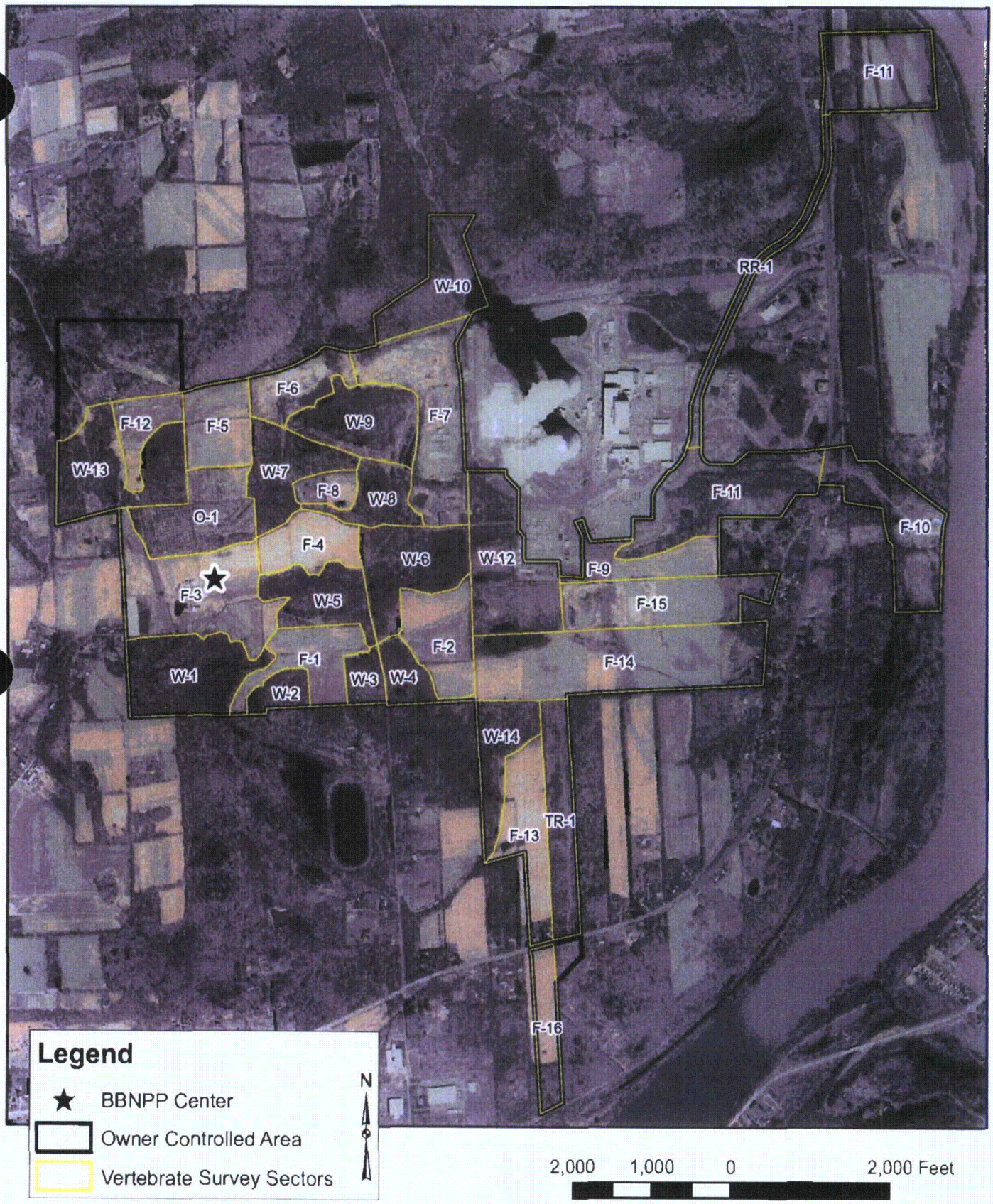

Figure 1.
Vertebrate survey sectors on the BBNPP site, May through September 2008.

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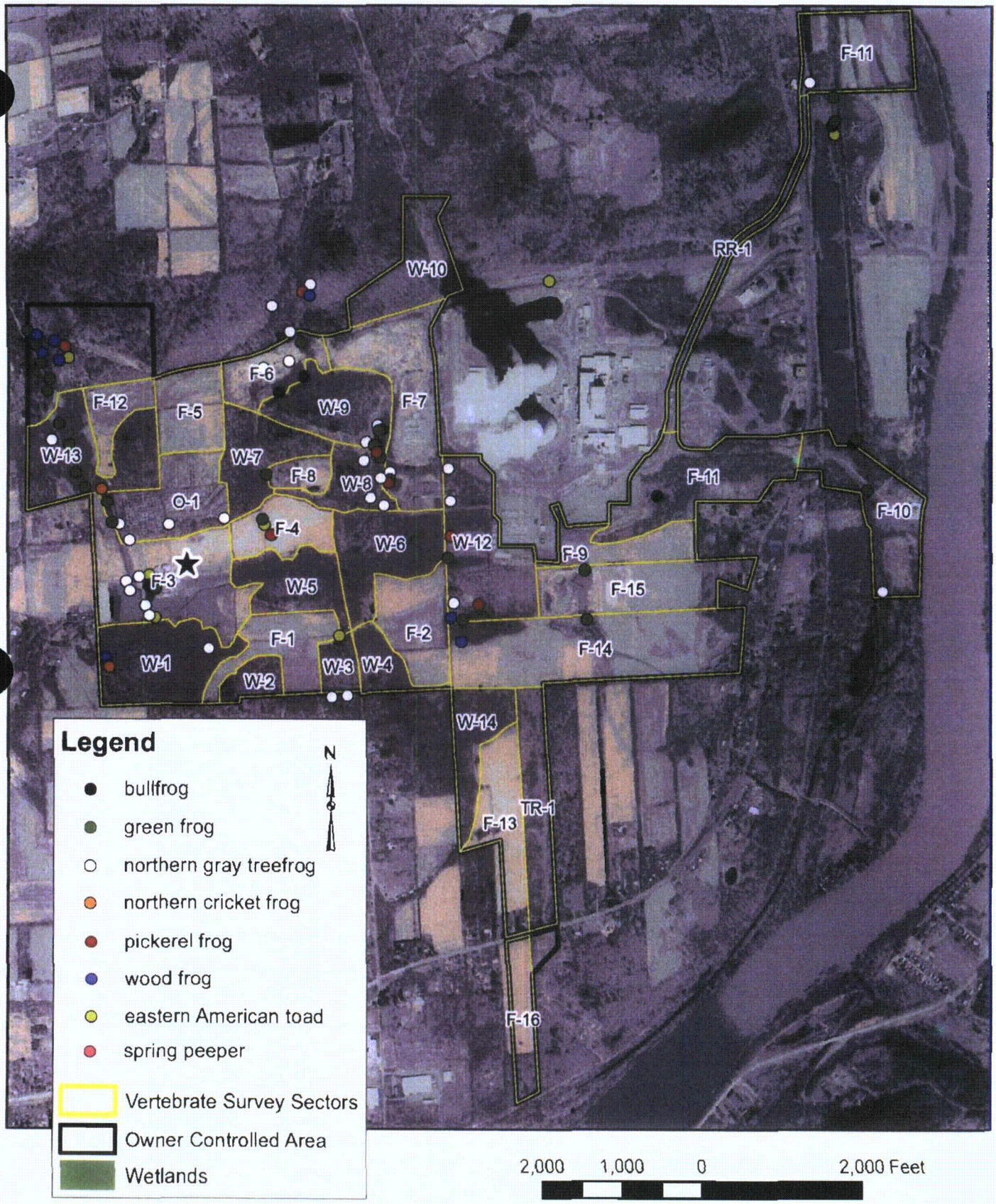

Figure 2.
Locations of observations for eight species of frogs and toads on the BBNPP site, May through September 2008.

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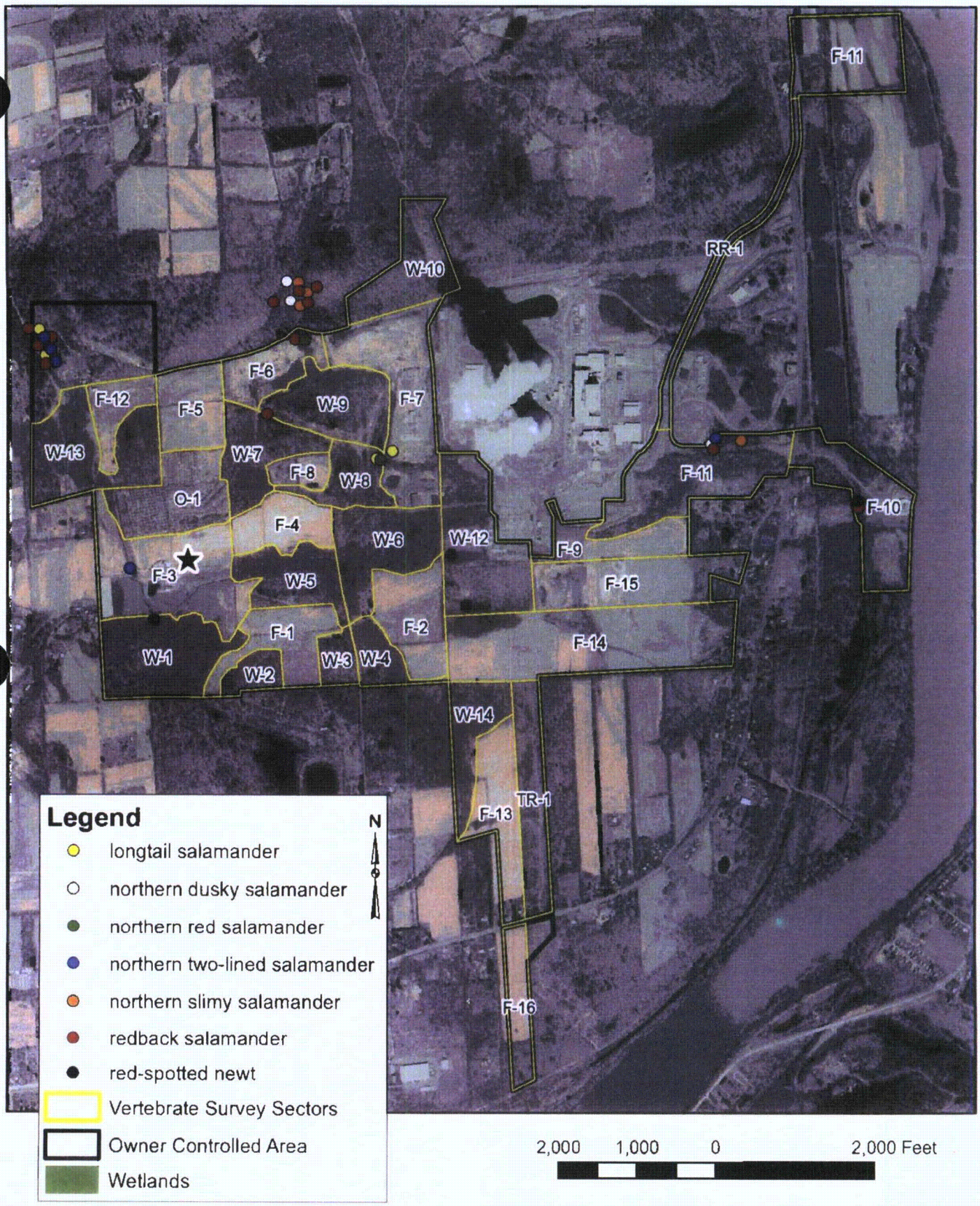

Figure 3.
Locations of observations for seven species of salamanders on the BBNPP site, May through September 2008.

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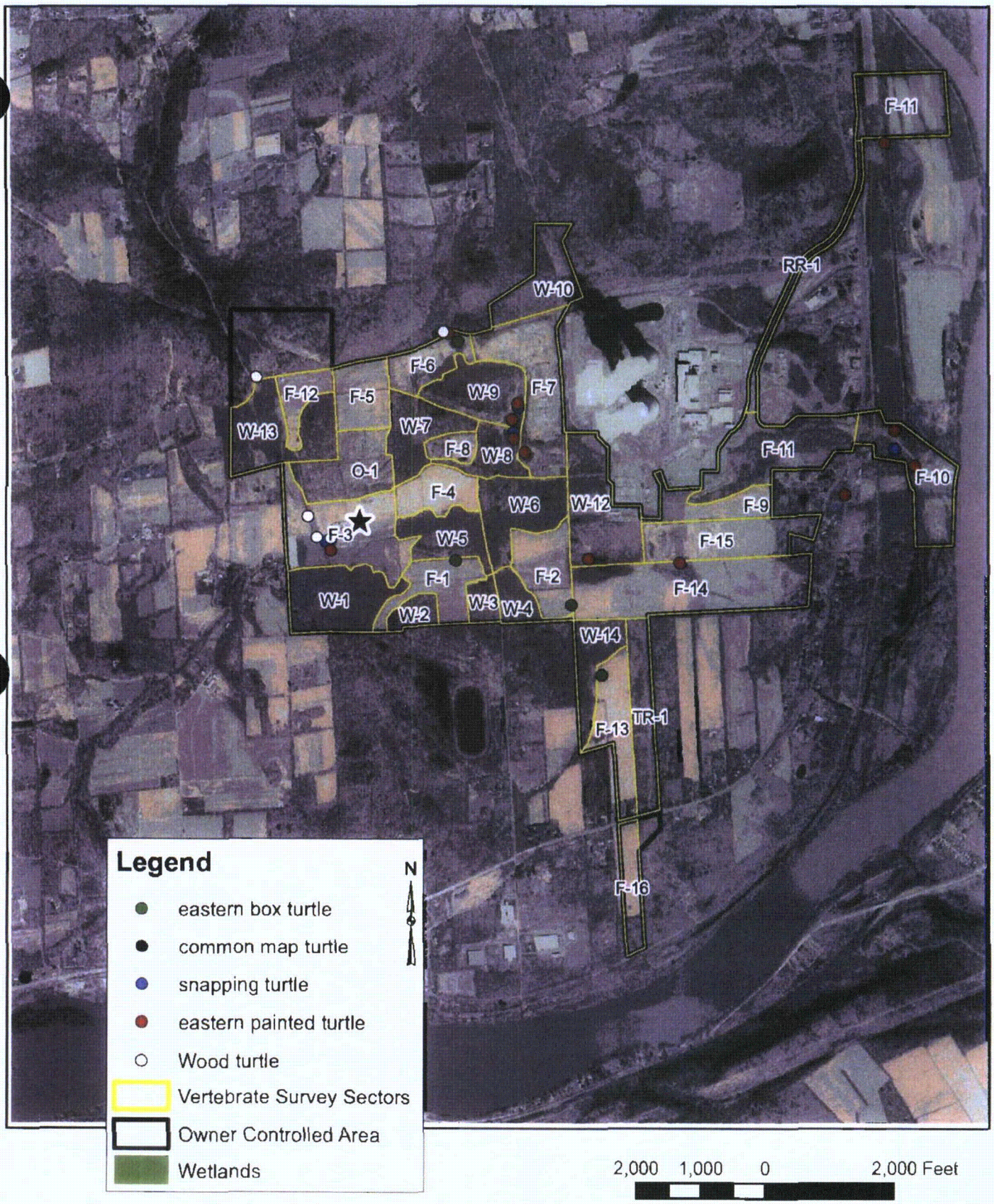

Figure 4.
Locations of observations for five species of turtles on the BBNPP site, May through September 2008.

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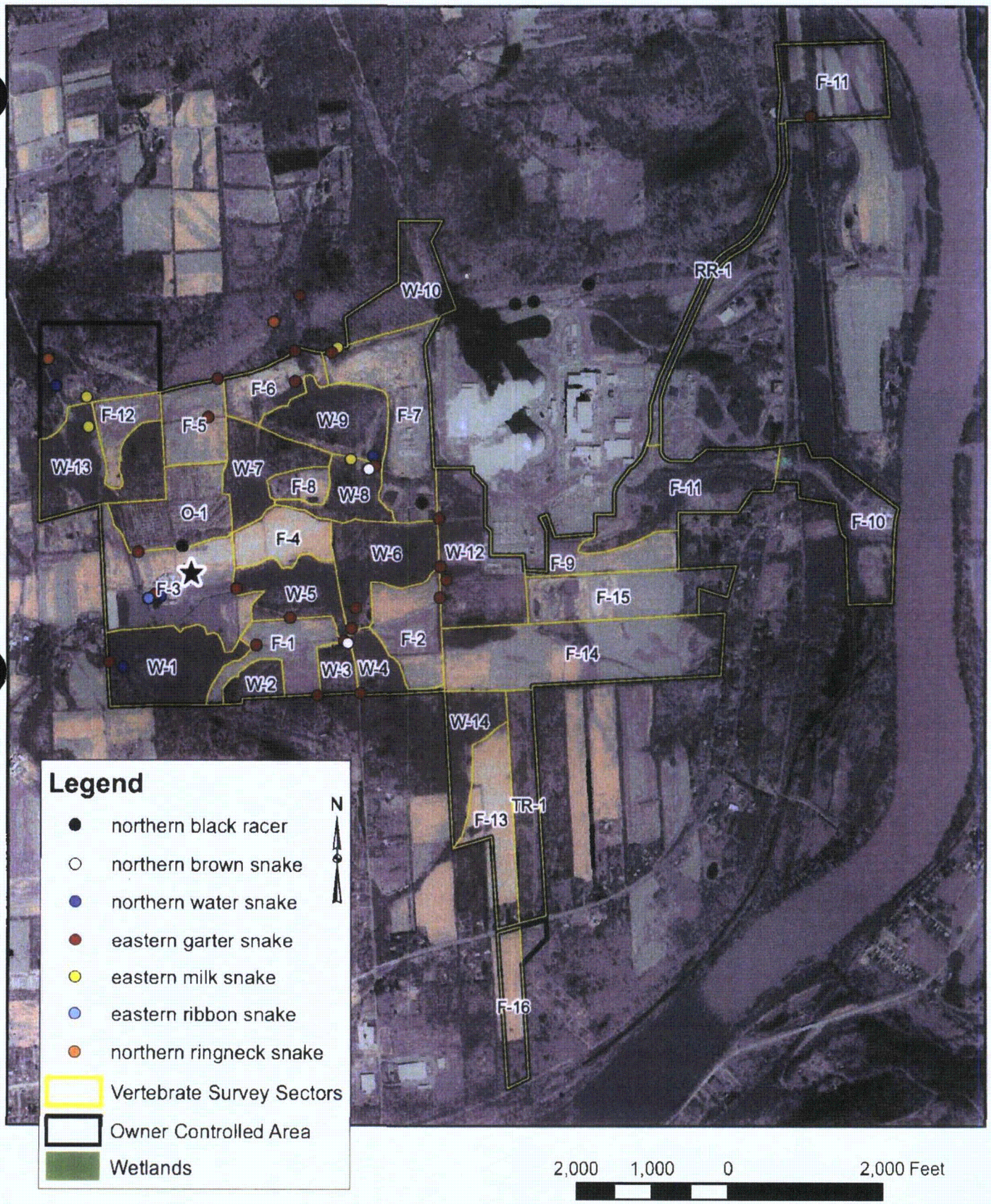

Figure 5.
Locations of observations for seven species of snakes on the BBNPP site, May through September 2008.

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APPENDIX B:

Report on Bell Bend Nuclear Power Plant Indiana Bat Mist Net Survey

Normandeau Project No. 21159.013

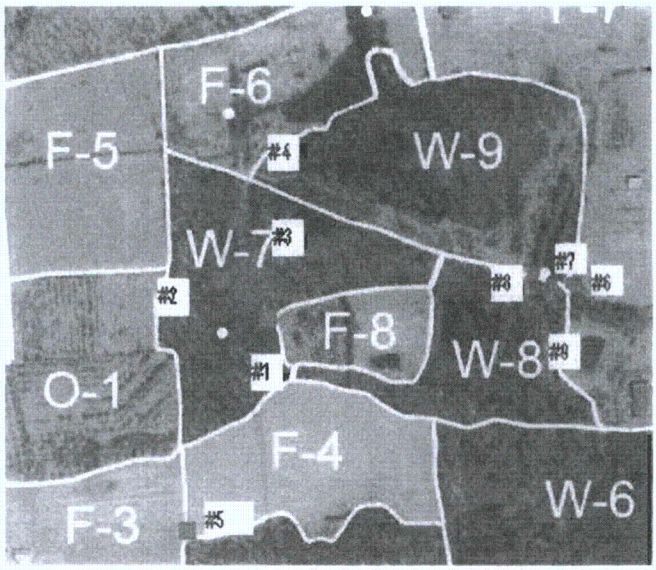
Protocol:

This survey was conducted from 6/7/08 to 7/11/08, comprising a total of 8 sampling nights as outlined below. A combination of mist nets were used on each of the sampling nights, including:

3 3-tier nets 9m (30') in height, at 6m (20') or 9m (30') widths
1 2-tier net 6m (20') in height, at 6m (20') or 9m (30') widths

Four (4) nets were set on all nights, for a total of 32 net-nights overall. Sampling was conducted at two main areas: along the road in W-7 and along the edge of the Beaver Pond adjacent to W-8, as shown on the following map. By the USFWS definition of two nets/site, two sites were sampled in W-7 for 5 nights, and two sites were sampled at the Beaver Pond at W-8/W-9, for 3 nights. Given low activity at net #4 in F-6, based upon no captures and very low acoustic indication of bat flight activity, net #4 in F-6 was replaced by net #5 in F-4 for 3 sampling nights. A total of 9 specific net sites were used, with the specific locations sampled on the nights indicated below:

Dates	Net#
6/7/08	1
6/8/08	2
	3
	4
6/26/08	1
7/01/08	2
7/02/08	3
	5
7/8/08	6
7/10/08	7
7/11/08	8
	9



An effort was made to place nets following potential travel corridors along the road in W-7 and along the edge of the Beaver Pond (W-8/W-9), although bat activity was monitored acoustically at a number of other sites to gain a sense of overall activity. Many areas on the property are open and so not suitable for netting (e.g F-3, F-4, O-1, F-5, F-8, F-6), although acoustic monitoring also detected low levels of activity. The dense vegetation in other areas (e.g. W-7, W-8, W-9) restricted the ability to set nets, but it is expected that bat flight activity would also be low in these congested locations. There are no permanent or seasonal waterways in this part of the property, which made it difficult to predict potential foraging sites. There is a small pond adjacent to the trailer in F-3, and a larger pond in F-6, and although there is bat activity over these ponds, it is not possible to capture bats in such open locations. Acoustic monitoring of bat activity was conducted both at net sites, at the ponds, and along transects across the property, to both provide information about bat activity and to guide the placement of nets in areas more likely to result in captures.

Captures:
A total of sixteen (16) bats representing three (3) species were captured during the survey:

Species	*Sex*	*Number of bats*	*Reproductive Status*
Big Brown Bat (*Eptesicus fuscus*)	F	2	lactating
Big Brown Bat (*Eptesicus fuscus*)	M	1	juvenile
Big Brown Bat (*Eptesicus fuscus*)	F	1	juvenile
Little Brown Bat (*Myotis lucifugus*)	M	3	adult
Little Brown Bat (*Myotis lucifugus*)	F	1	pregnant
Little Brown Bat (*Myotis lucifugus*)	F	4	lactating
Northern Long-eared Bat (*Myotis septentrionalis*)	M	4	adult

Specific details showing date of capture and net locations are shown in Appendix 2.

Each of the captured bats was tagged with a permanent, aluminum wrist-band for future identification, and this number will be included in a separate report to be filed with PA Game Commission.

Acoustic monitoring:
Bat activity was monitored acoustically using hand-held AnaBat ultrasonic detectors (Titley Electronics). These instruments have a detection frequency range of 10 – 200 kHz, and sufficient sensitivity to monitor bat echolocation calls flying along the netting corridors as well as above the tree canopy. Acoustic monitoring occurred at 20-minute intervals at each of the net sites throughout each sampling night. Additionally, bat activity was monitored at the beginning and end of each sampling night along transects perpendicular to the ridge away from each net site. The activity at the ponds was monitored separately, to gain a better appreciation for overall bat activity on the property.

The capture data reflects the generally low level of bat activity detected in the areas sampled, which was fairly uniform at each of the net sites as well as along transects through the surrounding area. Bat activity was uniformly low along the road in W-7, starting a less than 1 bat pass per minute at dusk as the nets were set, and dropping off through the survey period each night to less than 4 – 5 passes per hour after midnight. Generally, activity was a bit higher by the Beaver Pond, starting at 4 – 5 bat passes per minute at dusk, dropping to 1-2 passes per minute around midnight and falling off afterwards to less than one pass per minute. Temperatures were typically hot and humid at dusk throughout the survey period (daytime averages over 85° F), and remained elevated throughout the sampling each night, except for 7/10/08 when the temperature at midnight had dropped to 54°F. There were no captures that night.

Most of the activity was recorded from bats flying below canopy level, lower than the 3-tier (9m) mist nets, so the acoustic monitoring represents a reasonable estimate of bat activity along the corridors sampled that resulted in the captures reported. The echolocation signals detected were consistent with *E. fuscus* as well as

the *Myotis* species captured, but it is not possible to reliably distinguish between all *Myotis* species using acoustic methods. There was no indication of higher-flying species (like *L. borealis* or *L. cinereus*) which can readily be discriminated by their echolocation signatures.

Recommendations:
The capture of reproductively active (pregnant and lactating) females and juvenile bats suggests that this area supports maternity roosts of some bat species during the summer months. Although big brown bats (*E. fuscus*) and little brown bats (*M. lucifugus*) preferentially roost in human structures such as barns and attics, particularly when forming maternity colonies (Barbour and Davis, 1969), these bats can also form maternity roosts in tree cavities (Brigham, 1991; Fenton and Barclay, 1980). The capture of only adult male *Myotis septentrionalis*, which are tree-roosting species (Barbour and Davis, 1969), provides additional evidence for the existence of roost sites in the area surveyed, but not maternity colonies of females and young. While little brown bats tend to forage along the edges of wooded areas, *M. septentrionalis* is also known to forage in more cluttered forested areas, below the canopy but above the understory shrub layer (LaVal *et al.*, 1977). Both little brown bats and big brown bats have been shown to forage preferentially in riparian areas (Kurta, 1982), as have endangered Indiana Bats (Murray and Kurta, 2004). The absence of significant bodies of water on this property, and the low level of bat activity detected over the ponds present on the property, suggests that even resident bats might seek other areas over which to forage.

The primary objective of this survey was to determine the extent of Indiana bat (*Myotis sodalis*) activity in this area, with particular attention to summer habitat for roosting and reproduction. Despite suitable habitat for both roosting and foraging, there were no Indiana Bats (*Myotis sodalis*) captured during this survey. While we might expect capture rates of Indiana bats to be low, as other studies (e.g. Callahan *et* al., 1997; Kurta *et al.*, 1996) have shown that the bats roost singly or in small groups in hollow trees or underneath loose bark during the summer, there was potential for capture of Indiana Bats moving through the habitat if these bats were present in any reasonable number, as would be expected of resident bats.

The members of a maternity colony of Indiana bats typically roost in 10-20 trees each summer (Callahan *et al.*, 1997; Kurta *et al.*, 1996). Although some colonies restrict roosting to an area of only a few hectares, other Indiana bats use trees that are 8-9 km apart (Kurta *et al.*, 1996). Radio-tracking studies of the Indiana Bat (Murray and Kurta, 2004) show that these bats do not fly over open fields but travel along wooded corridors, even though such behavior may increase commuting distance by over 50%. Given this variability, it is difficult to predict the movements of bats within any one colony, but the failure to capture any Indiana Bats despite suitable roosting and foraging areas does not provide evidence for their presence on the site.

Based upon these results, particularly the failure to capture any *M. sodalis*, it would seem that the clearing of trees proposed for the development of the Bell Bend Nuclear Power Plant project is unlikely to have a direct impact on the roosting or foraging activity of Indiana Bats in this area. There is so little wooded habitat on the property, that it seems likely that other areas surrounding the site would provide more adequate roosting and foraging habitat for tree-roosting species, including the Indiana Bat. The presence of trees of the appropriate size and species in which bats might roost does not preclude the potential for roost colonies of several species (see Barbour and Davis, 1969), including those species captured in this study, as well as the Indiana Bat, despite the absence of captures. Development of this property should proceed with this potential in mind, by conserving candidate roost trees whenever possible and removing these trees when necessary during times outside the normal breeding season. Bats returning from hibernation typically resume residence in maternity roosts by late April, and most reproductive colonies have disbanded by late August, and so limiting the disturbance of the habitat to periods outside this breeding season will minimize the disruption of resident colonies.

Appendix 1: Details of bat captures

Capture date	Net #	Species	*Sex*	*Number of bats*	*Reproductive Status*
6/7/08	*2*	*M. lucifugus*	F	1	pregnant
	3	*M. lucifugus*	M	1	adult
	3	*M. septentrionalis*	M	1	adult
6/8/08	*1*	*M. septentrionalis*	M	1	adult
6/26/08	*2*	*M. lucifugus*	M	1	adult
7/1/08	*2*	*E. fuscus*	F	1	lactating
7/2/08	*1*	*E. fuscus*	F	1	lactating
	2	*M. septentrionalis*	M	1	adult
7/8/08	*7*	*E. fuscus*	M	1	juvenile
	7	*E. fuscus*	F	1	juvenile
	7	*M. lucifugus*	M	1	adult
	9	*M. lucifugus*	F	1	lactating
7/11/08	*7*	*M. lucifugus*	F	1	lactating
	7	*M. septentrionalis*	M	1	adult
	7	*M. lucifugus*	F	2	lactating

LITERATURE CITED:

Barbour, R.W. and W.H. Davis. 1969. Bats of America. The University Press of Kentucky, Lexington. 286 pp.

Brigham, R.M. 1991. Flexibility in foraging and roosting behaviour by the big brown bat (*Eptesicus fuscus*). Can. J. Zool. 69:117-121.

Callahan, E.V., R.D. Drobney and R.L. Clawson. 1997. Selection of summer roosting sites by Indiana bats (*Myotis sodalist)* in Missouri. J. Mammal. 78:818-825.

Fenton, M.B. and R.M.R. Barclay. 1980. *Myotis lucifugus*. Mammal. Sepcies 142:1-8.

Kurta, A. 1982. Flight patterns of *Eptesicus fuscus* and *Myotis lucifugus* over a stream. J. Mammal. 63(2): 335-337

Kurta A., K.J. Williams and R. Mies. 1996. Ecological, behavioral, and thermal observations of a peripheral population of Indiana bats (Myotis sodalis). Pp. 102-117 in Bats and forests. (R.M.R. Barclay and R.M. Brigham, eds.). Research Branch, Ministry of Forests, Province of British Columbia, Victoria, British Columbia, Canada.

LaVal, R.K., R.L. Clawson, M.L. LaVal and W. Caire. 1977. Foraging behavior and nocturnal activity patterns of Missouri bats, with emphasis on the endangered species *Myotis grisescens* and *Myotis sodalis*. J. Mammal. 58(4):592-599.

Murray, S.W. and A. Kurta. 2004. Nocturnal activity of the endangered Indiana bat (*Myotis sodalis*). Journal of Zoology 262:197-206.

APPENDIX C:

SURVEY OF RARE BUTTERFLIES AT BBNPP SITE
Location: Bell Bend tract in Salem Twp., Luzerne Co.

First Survey Date: June 12, 2008

Methods: I spent 6 hours searching the tract for adults and appropriate habitat of two species of butterfly turned up in a PNDI review of the property. The weather was excellent for insect activity with mostly sunny skies and temperatures in the mid-80's between the hours of 9:30 AM to 3:30 PM. I searched appropriate habitat for adult butterflies near food plants and on nectar sources. I used a pair of 8X binoculars and also carried a net to collect voucher specimens where appropriate.

Findings: I collected one worn female of *Polites mystic* (Long Dash) in a powerline right-of-way (see attached map). The area appeared to be good habitat for this species with a mixture of wet meadow and emergent marsh vegetation. Based on the condition of this specimen, I speculate that the first brood of this species was almost over and I probably would have found more individuals had I been there 1-2 weeks earlier.

I found no evidence of *Euphydras phaeton* (Baltimore Checkerspot) on site despite being there during the period when the adults should be flying and having excellent weather conditions. The habitat of the large emergent marsh to the south of the BBNPP trailer (see attached map) looked very good for this species. I did not locate any Turtlehead, the preferred larval food plant, but I did see a few Hairy Beardtongue plants which are listed as an alternate larval host. This species is large and conspicuous and would be difficult to miss.

Species observed during the survey:
Spicebush, Tiger, and Black Swallowtails, Clouded and Orange Sulfurs, Cabbage Butterfly, Meadow and Great-spangled Fritillaries, Question Mark, Viceroy, Red-spotted Purple, Painted Lady, Eastern Tailed-blue, Summer Azure, Little Wood Satyr, Common Ringlet, Juvenal's Duskywing, Northern Cloudywing, Silver-spotted, European, Least, Peck's, Long Dash, and Hobomoke Skippers

Second Survey Date: July 18, 2008

Methods: I spent 4 hours searching the tract for adults and appropriate habitat of two additional species of butterfly turned up in a PNDI review of the property. The weather was excellent for insect activity with mostly sunny skies and temperatures in the high 80's to low 90's between the hours of 10:00 AM to 2:00 PM. I searched appropriate habitat for adult butterflies near food plants and on nectar sources. I used a pair of 8X binoculars and also carried a net to collect voucher specimens where appropriate.

Findings: I collected a pair and observed at least 8-10 more individuals of *Euphyes conspicua* (Black Dash) in the same marsh referenced above. Adults were perching on vegetation and nectaring on Swamp Milkweed blossoms. This is a PNDI tracked species with a state rank of S3. I did not find any *Poanes massasoit* (Mulberry Wing) in this same marsh despite an exhaustive search. I also did not see any *E. phaeton* on this second visit either. I also searched an area of open woodlands near the

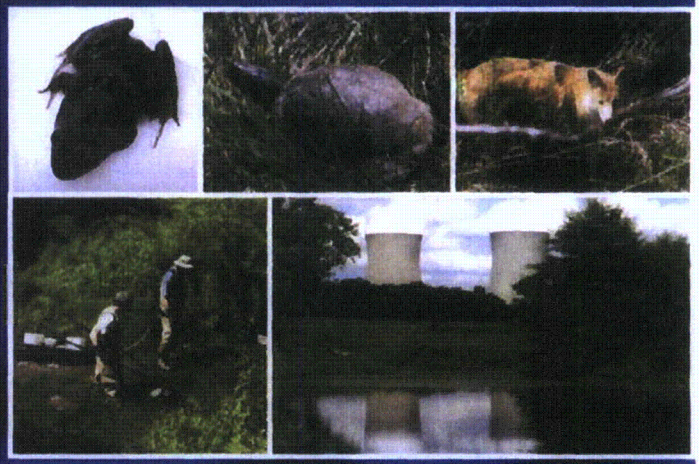
Susquehanna River for *Enodia anthedon* (Northern Pearly-eye) but I did not locate this species either. This is another large and conspicuous species that would be difficult to overlook.

Additional species observed during the second survey:
Silver-bordered Fritillary, Pearl Crescent, Appalachian Eyed-brown, Black Dash, Dun Skipper.

Submitted by: Daniel Bogar

Final

A Field Survey of Plant Communities at the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania



Submitted to:
AREVA NP, Inc.
Marlborough, MA

September 2008

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

A Field Survey of Plant Communities at the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania

Prepared for:

AREVA NP, Inc.

Marlborough, MA

Prepared by:

Normandeau Associates, Inc.

Stowe, PA

September 2008

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INTRODUCTION

Bell Bend Nuclear Power Plant (BBNPP) is proposed to be sited adjacent to the Susquehanna Steam Electric Station in Salem Township, Luzerne County, Pennsylvania (Figure 1). Normandeau Associates, Inc. was contracted by AREVA NP, Inc. to map the terrestrial plant communities on the proposed BBNPP owner controlled area (OCA). Herein the OCA is referred to as the site.

Personnel

This plant communities report for the BBNPP site is the product of efforts from many well-trained personnel. The overall effort was coordinated by Project Manager Paul Harmon and Principal Ecologist Robert Blye. Field work was accomplished by Normandeau biologists Elizabeth Garlo, Jayme Schaeffer, Chris Roche and Keith Maurice. Dr. James Montgomery of Ecology III, Inc. also participated in the field work and provided technical assistance. Keith Maurice prepared the report, and Melonie Ettinger and Brenda Strouse provided secretarial support.

METHODS

Mapping of terrestrial plant communities was initiated by a review of relevant literature and readily available natural resources mapping in order to anticipate the distribution of plant communities across the site. References consulted included the Natural Resources Conservation Service Luzerne County Soil Survey, National Wetlands Inventory mapping, aerial photography and information on plant species of special concern. Field mapping took place during the period of July 2007 through August 2008 in combination with wetlands delineation field studies. Documentation of the plant communities included an inventory of common plant species and representative photographs.

SITE DESCRIPTION

The BBNPP site extends across 882 acres (1.38 mile^2) of property adjacent to the PPL Susquehanna Steam Electric Station (SSES) in Salem Township, Luzerne County, Pennsylvania (Figure 1). The terrain is variable and ranges from steeply sloping hills in the west to the relatively level floodplain of the Susquehanna Riverlands in the east. Net relief is approximately 400-feet.

Landuses consist largely of cropland, fallow farmland including an abandoned orchard and deciduous forest. Prominent hydrologic features include the Susquehanna River, Walker Run, the North Branch Canal, several former farm ponds and a beaver pond. Man-made features consist of two active gravel quarries, several outlying SSES facilities and electric transmission line corridors, and two large soil stockpiles resulting from SSES construction in the 1970s. An aerial view of the site layout is presented in Figure 2.

RESULTS AND DISSCUSSION

The Bell Bend site encompasses large tracts of upland plant communities, wetland plant communities, agricultural land and developed properties including several active gravel quarries (Figure 3). Descriptions of the upland and wetland communities are presented in the following sections.

Upland Plant Communities

Old Field/Former Agricultural

Old-field vegetation cover is composed of a variety of grasses and herbaceous plants. During 2007, old-field vegetation extended over much of the fallow farmland in the western section of the site. However, during 2008 some of this habitat was returned to agricultural use for the production of corn. Dominant old field species include daisy fleabane (*Erigeron annuus*), Canada thistle (*Cirsium*

arvense), wrinkled goldenrod (*Solidago rugosa*), flat-top fragrant goldenrod (*Euthamia graminifolia*), Canada goldenrod (*Solidago canadensis*), giant foxtail grass (*Setaria faberi*), white heath aster (*Aster pilosus*), lamb's quarters (*Chenopodium album*), red clover (*Trifolium pretense*) and common ragweed (*Ambrosia artemisiifolia*).

Included with this habitat type in Figure 3 is an abandoned apple orchard several acres in size which is located on the hillside immediately north of the proposed location for the power block. A list of common plant species observed in the BBNPP site is presented in Table 1.

Upland Scrub/Shrub

Upland shrub habitat occurs mostly along transmission line corridors and in several abandoned farm fields located around the site that are undergoing secondary succession. This community consists primarily of bush honeysuckle (*Lonicera tatarica*), multiflora rose (*Rosa multiflora*), Allegheny blackberry (*Rubus allegheniensis*), and Russian olive (Elaeagnus angustifolia).

Upland Deciduous Forest

Upland deciduous forest covers a large portion of the site to the west of Route 11. Common overstory species include northern red oak (*Quercus rubra*), white oak (*Quercus alba*), black cherry (*Prunus serotina*), white ash (*Fraxinus americana*), shagbark hickory (*Carya ovata*), bitternut hickory (*Carya cordiformis*), sweet birch (*Betula lenta*), black walnut (*Juglans nigra*), black locust (*Robinia pseudoacacia*), yellow poplar (*Liriodendron tulipifera*) and red maple (*Acer rubrum*).

Upland forest understories are composed predominantly of spicebush (*Lindera benzoin*), round-leaved greenbrier (*Smilax rotundifolia*), Virginia creeper (*Parthenocissus quinquefolia*) and saplings of overstory species. Groundcover

species include may-apple (*Podophyllum peltatum*), garlic mustard (*Allaria petiolata*), hayscented fern (*Dennsteadtia punctilobula*), tree clubmoss (*Lycopodium obscurum*), partridge berry (*Mitchella repens*), ground cedar (*Lycopodium tristachyum*) and stilt grass (*Eulalia viminea*).

Wetland Plant Communities

Palustrine Emergent Wetlands

Palustrine emergent wetlands are located throughout the site. A diverse group of herbaceous hydrophytic plants is present including soft rush (*Juncus effusus*), sedges (*Carex spp.*), arrow-leaf tearthumb (*Polygonum sagittatum*), common boneset (*Eupatorium perfoliatum*), giant goldenrod (*Solidago gigantea*), seedbox (*Ludwigia alternifolia*), nutsedges (*Cyperus spp.*), blue vervain (*Verbena hasta*), New York ironweed (*Vernonia noveboracensis*), swamp aster (*Aster puniceus*), cut-leaf coneflower (*Rudbeckia laciniata*), broad-leaved cattail (*Typha latifolia*), reed canary grass (*Phalaris arundinacea*) and purple loosestrife (*Lythrum salicaria*).

Palustrine Scrub/Shrub Wetlands

Several large palustrine scrub/shrub wetlands are located immediately southwest of SSES and hydrophytic shrubs are a common component of many wetlands across the BBNPP site. Spicebush is overwhelmingly the most abundant wetland-preferring shrub onsite. Other frequently occurring wetland shrubs are highbush blueberry (*Vaccinium corymbosum*), meadowsweet (*Spirea latifolia*), alders (*Alnus spp.*), silky dogwood (*Cornus ammomum*), arrow-wood (*Viburnum dentatum*) and grey dogwood (*Cornus racemosa*).

Palustrine Forested Wetlands

Palustrine forested wetlands are the principal wetland type in the BBNPP site,

and large contiguous blocks of this habitat are associated with Walker Run and its eastern tributary. Trees commonly found in forested wetlands onsite include red maple (*Acer rubrum*), silver maple (*Acer saccharinum*) black gum (*Nyssa sylvatica*), pin oak (*Quercus palustris*) and river birch (*Betula nigra*). In addition, upland-preferring species such as white ash and yellow poplar are present on microsites scattered throughout some forested wetlands.

Wetland forest understories are comprised largely of spicebush, highbush blueberry, arrow-wood and winterberry (*Ilex verticellata*). Skunk cabbage (*Symplocarpus foetidus*) predominates in the groundcover along with sedges, jewelweed (*Impatiens capensis*), sensitive fern (*Onoclea sensibilis*), clearweed (*Pilea pumila*), cinnamon fern (*Osmunda cinnamomea*), stout woodreed grass (*Cinna arundinacea*), and swamp dewberry (*Rubus hispidus*).

INVASIVE EXOTIC PLANT SPECIES

Non-native invasive plants occur abundantly within particular upland and wetland habitats in the BBNPP site. Wetland invaders include reed canary grass, purple loosestrife, and common reed (*Phragmites australis*), which are herbaceous plants that commonly colonize emergent wetland habitat. Reed canary grass is a dominant species throughout much of the emergent wetlands onsite and forms monocultures in some areas. Purple loosestrife is moderately abundant and common reed is currently limited to a small foothold near the southeastern corner. These species will likely colonize additional emergent wetland habitat over time.

Upland invaders include garlic mustard, stilt grass, multiflora rose and bush honeysuckle. Garlic mustard and stilt grass are herbaceous plants that are very common in the groundcover of upland forests. Multiflora rose and bush honeysuckle are shrubs that occur in dense concentrations in successional old-field habitat and along forest edges.

Native species of wildlife are adapted to habitats made up of indigenous vegetation. Typically, non-native plants have little or no value to native animals. Aggressive non-native plants, such as those identified above, tend to spread rapidly, form monocultures and out-compete native flora, which results in negative consequences for native wildlife.

SPECIES OF SPECIAL CONCERN

Information concerning the presence of threatened, endangered, and other special concern plants within a 0.5-mile radius of an area encompassing the site, PPL-owned lands to the north and the Susquehanna Riverlands was requested via correspondence submitted 21 December 2007 to the U. S. Fish and Wildlife Service (USFWS) and Pennsylvania Department of Conservation and Natural Resources (PDCNR). USFWS jurisdiction includes flora designated as listed, proposed or candidate under the Federal Endangered Species Act. PDCNR has jurisdiction over flora and natural communities considered to be rare in Pennsylvania. Neither agency reported any known occurrences of plants designated as threatened, endangered or of special concern within the search area (USFWS 2008 and PDCNR 2008). No threatened, endangered or other special concern plants were observed during Normandeau's field surveys.

REFERENCES

Gleason, H.A. and A. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. The New York Botanical Garden. Bronx, New York.

Harlow, William M. 1957. Trees of the Eastern and Central United States and Canada. Dover Publications, Inc., New York, New York.

Holmgren, N.H. 1998. Illustrated Companion to Gleason and Cronquist Manual. The New York Botanical Garden. Bronx, New York.

Normandeau Associates, Inc. 2008 Wetlands Delineation and Exceptional Value Wetlands Analysis Report, for Proposed UniStar Nuclear Project Area, Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania." Normandeau Associates, Inc., Stowe, Pennsylvania.

Newcomb, Lawrence. 1977. Newcomb's Wildflower Guide. Little, Brown and Company. Boston, Massachusetts.

Pennsylvania Department of Conservation and Natural Resources. 2005. PAMAP Program 2005 Color Orthophotos of Luzerne County, Pennsylvania. Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey, Harrisburg, Pennsylvania.

Pennsylvania Department of Conservation and Natural Resources. 2008. Letter from Rebecca H. Bowden to George Wrobel (CEG GNA Engineering), Re: Environmental Review of Bell Bend Nuclear Power Plant Site, Berwick, Luzerne County, Pennsylvania, Dated: March 24, 2008.

Pennsylvania Natural Heritage Program. 2006. A Natural Areas Inventory Luzerne County, Pennsylvania. Western Pennsylvania Conservancy, Middletown, Pennsylvania.

Peterson, Roger Tory and Margaret McKeany. 1986. A Field Guide to Wildflowers, Northeastern/Northcentral North America. Houghton Mifflin Company. Boston, Massachusetts.

Petrides, George A. 1986. Trees and Shrubs. Houghton Mifflin Company. Boston, Massachusetts.

Rhodes, A. and W. McKinley, Jr. 1993. The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas. American Philosophical Society. Philiadelphia, Pennsylvania.

Strausbaugh, P. D. and Earl Core. 1977. Flora of West Virginia, Second Edition, Seneca Books, Inc., Grantsville, West Virginia.

U.S. Army Corps of Engineers. 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1, U.S. Army Engineer Experiment Station, Vicksburg, Mississippi.

U.S. Fish and Wildlife Service. 2008. Letter from David Densmore to Rod Krich (Unistar Nuclear), Re: USFWS Project #2008-518, Federally Listed Endangered and Threatened Species for the Bell Bend Nuclear Power Plant Site, Berwick, Luzerne County, Pennsylvania, Dated: January 18, 2008.

Table 1. Common plants identified in the Bell Bend NPP Owner Controlled Area.

Scientific Name	Common Name
Trees and Saplings	
Acer saccharinum	silver maple
Acer rubrum	red maple
Ailanthus altissima	tree-of-heaven
Betula alleghaniensis	yellow birch
Betula lenta	sweet birch
Betula nigra	river birch
Betula populifolia	gray birch
Carya cordiformis	bitternut hickory
Carya ovata	shagbark hickory
Carya tomentosa	mockernut hickory
Celtis occidentalis	hackberry
Cornus florida	flowering dogwood
Fagus grandifolia	American beech
Fraxinus americana	white ash
Juglans nigra	black walnut
Juniperus virginiana	eastern red cedar
Liriodendron tulipifera	yellow poplar
Malus spp.	apples
Nyssa sylvatica	black gum
Pinus resinosa	red pine
Pinus strobus	eastern white pine
Pinus sylvestris	Scots pine
Platanus occidentalis	American sycamore
Populus tremuloides	quaking aspen
Prunus serotina	black cherry
Quercus alba	white oak
Quercus bicolor	swamp white oak
Quercus palustris	pin oak
Quercus rubra	northern red oak
Quercus velutina	black oak
Robinia pseudoacacia	black locust
Sassafras albidum	sassafras
Tilia americana	American basswood
Tsuga canadensis	eastern hemlock
Ulmus rubra	slippery elm
Woody Vines	
Lonicera japonica	Japanese honeysuckle
Parthenocissus quinquefolia	Virginia creeper
Rubus flagellaris	northern dewberry
Smilax glauca	cat greenbrier
Smilax rotundifolia	common greenbrier
Toxicodendron radicans	poison ivy

Table 1. (Continued)

Scientific Name	Common Name
Shrubs	
Alnus spp.	alders
Cornus amomum	silky dogwood
Cornus racemosa	swamp dogwood
Elaeagnus angustifolia	Russian olive
Ilex verticillata	winterberry
Kalmia latifolia	mountain laurel
Ligustrum obtusifolium	privet
Lindera benzoin	northern spicebush
Lonicera tatarica	tartarian honeysuckle
Rhus typhina	staghorn sumac
Rosa multiflora	multiflora rose
Rubus allegheniensis	Allegheny blackberry
Rubus occidentalis	black raspberry
Sambucus canadensis	American elder
Salix discolor	pussy willow
Spirea latifolia	broad-leaf meadow-sweet
Vaccinium corymbosum	highbush blueberry
Viburnum cassinoides	withe-rod
Viburnum dentatum	arrow-wood
Viburnum prunifolium	black-haw
Herbs	
Achillea millefolium	common yarrow
Acorus calamus	sweetflag
Agropyron repens	quack grass
Agrostis gigantea	redtop grass
Alliaria petiolata	garlic mustard
Allium vineale	field garlic
Ambrosia artemisiifolia	common ragweed
Anthoxanthum odoratum	sweet vernal grass
Apocynum cannabinum	clasping leaf dogbane
Arctium minus	common burdock
Arisaema triphyllum	swamp jack-in-the-pulpit
Artemisia vulgaris	mugwort
Asclepias incarnata	swamp milkweed
Asclepias syriaca	common milkweed
Aster pilosus	white heath aster
Aster puniceus	swamp aster
Barbarea vulgaris	winter-cress
Bidens spp.	beggar-ticks
Boehmeria cylindrica	false nettle
Bromus inermis	smooth brome grass
Carex spp.	sedges

Table 1. (Continued)

Scientific Name	Common Name
Herbs	
Carex lurida	shallow sedge
Carex stricta	uptight sedge
Chenopodium album	lamb's quarters
Cicuta bulbifera	water hemlock
Cinna arundinacea	stout wood-reedgrass
Cirsium arvense	Canada thistle
Cirsium vulgare	bull thistle
Claytonia virginica	spring beauty
Conyza canadensis	horseweed
Coronilla varia	crown-vetch
Cyperus spp.	nutsedges
Dactylis glomerata	orchard grass
Dennstaedtia punctilobula	hayscented fern
Dichanthelium clandestinum	deer-tongue grass
Dipsacus sylvestris	teasel
Eleocharis spp.	spikerushes
Erechtites hieraciifolia	American burn
Erigeron annuus	daisy fleabane
Eulalia viminea	Nepal microstegium
Eupatoriadelphus spp.	Joe-Pye-weed
Eupatorium perfoliatum	common boneset
Euthamia graminifolia	flat-top fragrant goldenrod
Galium mollugo	wild madder
Geum canadense	white avens
Glyceria striata	fowl manna grass
Hesperis matronalis	dames rocket
Holcus lanatus	common velvet grass
Hypericum perforatum	St. John's wort
Impatiens capensis	jewelweed
Juncus effusus	soft rush
Juncus tenuis	path rush
Lamium purpureum	purple dead nettle
Leersia oryzoides	rice cutgrass
Leucanthemum vulgare	oxeye daisy
Lotus corniculatus	birds-foot trefoil
Ludwigia alternifolia	seedbox
Ludwigia palustris	marsh seedbox
Lycopodium obscurum	tree clubmoss
Lycopodium tristachyum	ground cedar
Lycopus spp.	bugleweeds
Lysimachia ciliata	fringed loosestrife
Lysimachia nummularia	moneywort
Lythrum salicaria	purple loosestrife
Maianthemum canadense	false lily-of-the-valley

Table 1. (Continued)

Scientific Name	Common Name
Herbs	
Mitchella repens	partridge-berry
Oenothera biennis	common evening-primrose
Osmunda cinnamomea	cinnamon fern
Oxalis spp.	wood-sorrels
Panicum dichotomiflorum	fall panic grass
Phalaris arundinacea	Reed canary grass
Phleum pretense	timothy grass
Phragmites australis	common reed
Phytolacca americana	common pokeweed
Plantago lanceolata	English plantain
Plantago major	common plantain
Pilea pumila	clearweed
Podophyllum peltatum	may-apple
Polygonum arifolium	halberd-leaf tearthumb
Polygonum cespitosum	cespitose knotweed
Polygonum perfoliatum	mile-a-minute
Polygonum sagittatum	arrow-leaved tearthumb
Polygonum virginianum	Virginia knotweed
Prunella vulgaris	heal-all
Rubus hispidus	bristly blackberry
Rudbeckia hirta	black-eyed Susan
Rudbeckia laciniata	cut-leaf coneflower
Rumex crispus	curly dock
Sagittaria latifolia	broad-leaf arrow-head
Saponaria officinalis	bouncing-bet
Schizachrium scoparium	little bluestem
Scirpus cyperinus	wool-grass
Scirpus spp.	bulrushes
Setaria faberi	Japanese bristle grass
Setaria glauca	yellow bristle grass
Solanum carolinense	Carolina nightshade
Solidago canadensis	Canada goldenrod
Solidago gigantea	giant goldenrod
Solidago rigida	stiff goldenrod
Solidago rugosa	wrinkled goldenrod
Sparganium spp.	burreeds
Symplocarpus foetidus	skunk-cabbage
Taraxacum officinale	common dandelion
Tridens flavus	purple-top tridens
Trifolium pretense	red clover
Typha latifolia	broad-leaved cattail
Urtica dioica	stinging nettle

Table 1. (Continued)

Scientific Name	Common Name
Herbs	
Verbascum blattaria	moth mullein
Verbascum thapsus	common mullein
Verbena hastata	blue vervain
Vernonia noveboracensis	New York ironweed

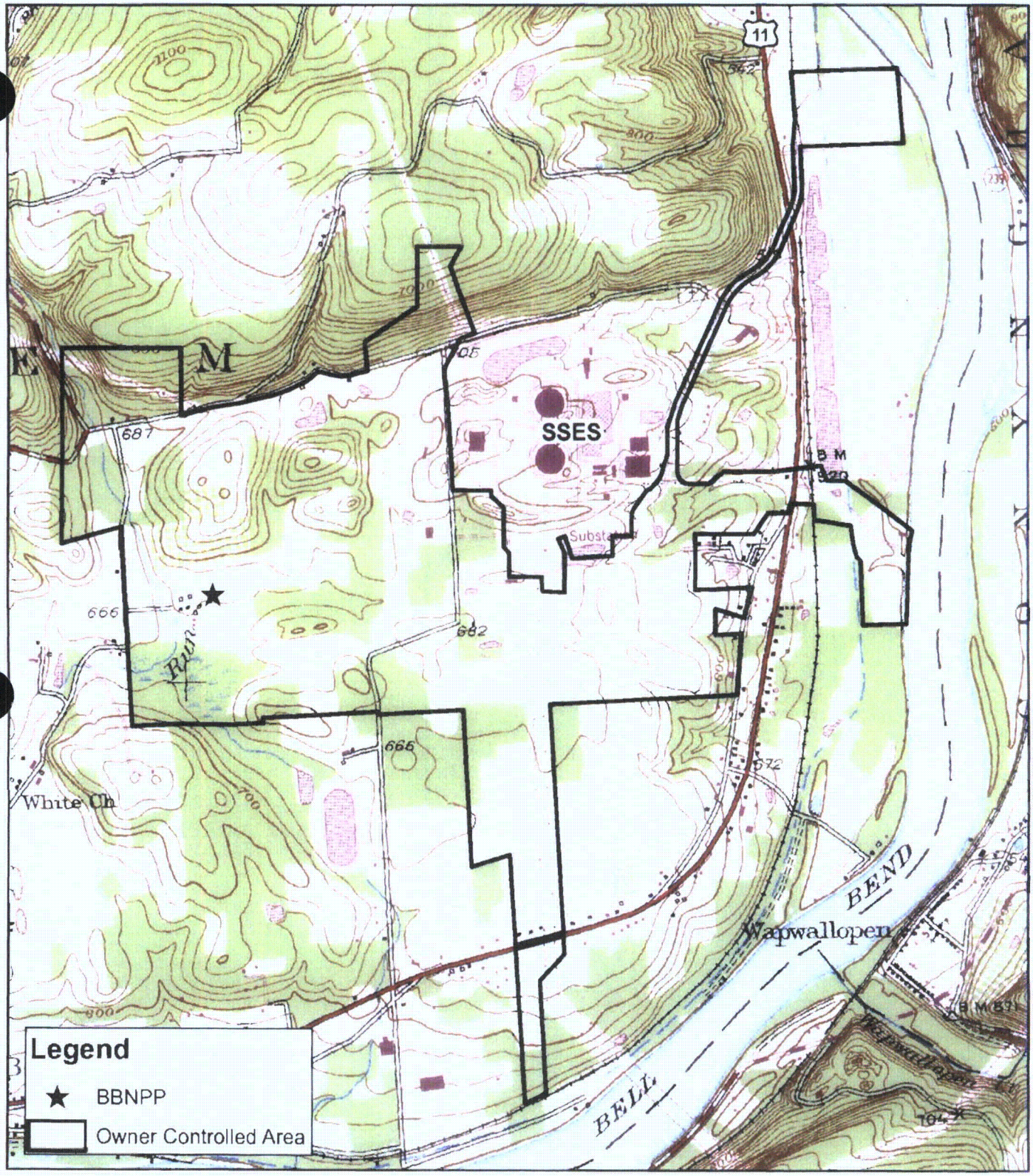

Figure 1.
Bell Bend NPP
Site Location Map

N

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date: 09/11/08
project: 21159.000
prepared by: s.sherman

checked by: k.maurice
project name: Bell Bend
file name: Fig1.BBNPP_Flora_SiteLocation

0.5 0.25 0 0.5 Miles

Figure 2.
Bell Bend NPP
Site Aerial Photograph

N

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date: 09/11/08
project: 21159.000
prepared by: s.sherman

checked by: k.maurice
project name: Bell Bend
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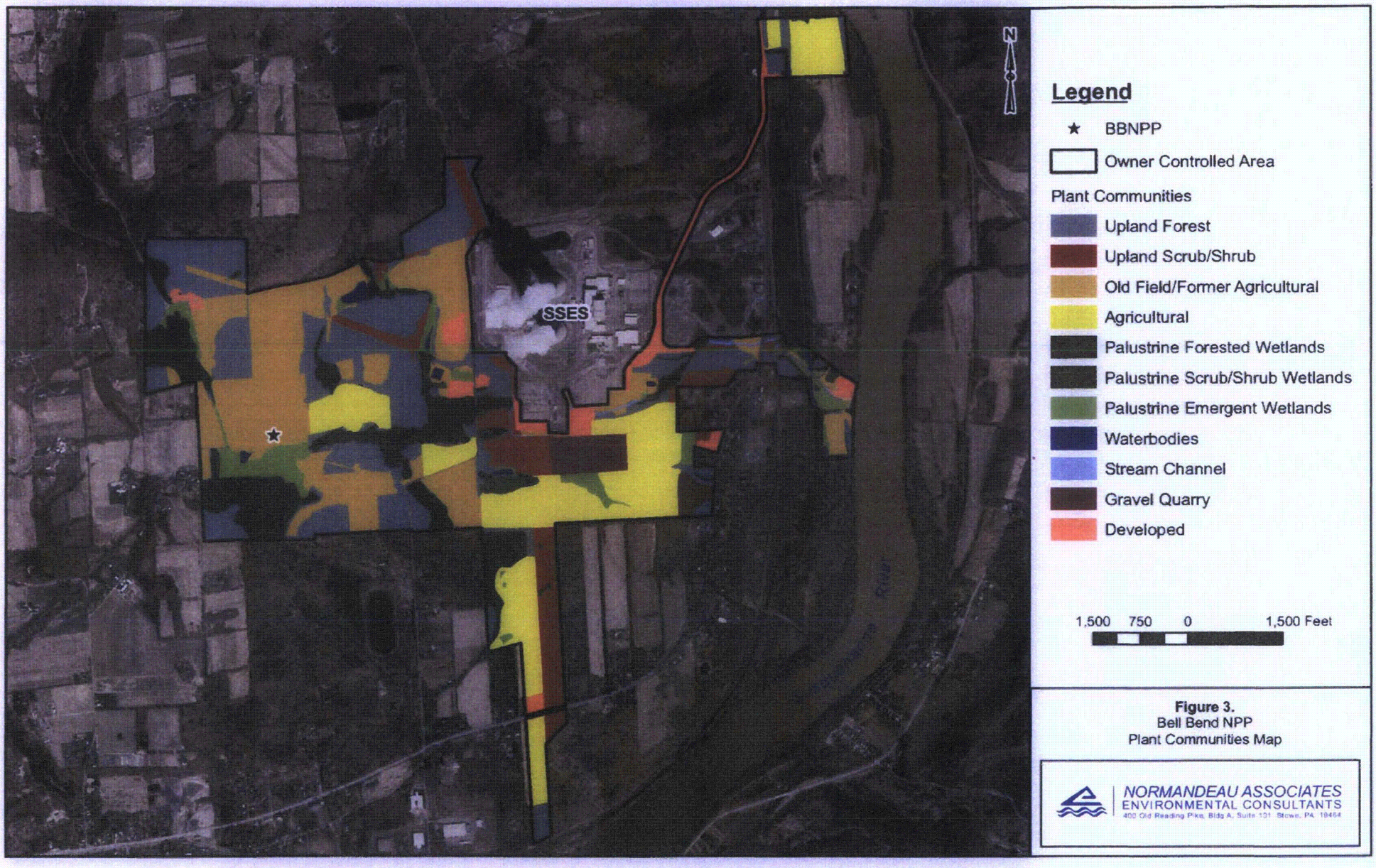

Figure 3.
Bell Bend NPP
Plant Communities Map

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