

**Inventory of Reptiles and Amphibians
Morristown National Historical Park
2000**

**Wildlife Conservation Society - National Park Service
Cooperative Agreement**

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22 species
Should have list cost
add abundance, etc

who
checked 3/14/02

Greg
Fred

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PROJECT DESCRIPTION

Cooperative Agreement

The Wildlife Conservation Society (WCS) in a partnership with the National Park Service (NPS) created a Cooperative Agreement to inventory nine Northeast Region National Parks for reptiles and amphibians. This coincides with a NPS program to assess natural resources under its stewardship (Behler 1999).

Primary Objectives

Both quantitative and qualitative observations and data acquisition will be combined for the purpose of documenting the presence of reptile and amphibian species (herpetofauna) and their habitats at each NPS site. More specifically, this project will determine the occurrence, abundance, and distribution of the herpetofauna within Morristown National Historical Park, determine the status and identify habitats of state and federally listed Threatened, Endangered and Special Concern species, and provide a foundation for long-term monitoring and management practices. In addition, data from this project will be compared with historical information to begin to obtain a general understanding of trends and changes in specific habitats, species composition, and population sizes.

THE SITE

Morristown National Historical Park (MORR) is located in western Morris County, of north-central New Jersey, approximately 30 miles west of New York City. Historically, the park's natural areas served as winter encampment sites for General George Washington's army between 1779-1780. The park includes four fragmented sections (Appendix 1) making up the 1,685 acres of land, most of which is located outside city boundaries in residential areas. Only two of these sections were included in this herpetological inventory. The Jockey Hollow Encampment Unit is the largest area (1,320 acres) and lies approximately 5 miles southwest of Morristown. The New Jersey Brigade Unit is located approximately 2 miles from the Jockey Hollow site. A single footpath, the Patriots Path Trail, connects both sites. MORR is bordered by Morris Area Girl Scouts of America Council land to the west, Lewis Morris County Park to the north, and the 265 acre Scherman-Hoffman Sanctuary of the New Jersey Audubon Society to the south. Old Jockey Hollow Road creates the western boundary for the New Jersey Brigade unit of the park, while U.S. Route 202 lies adjacent to the southeastern segments and Tempe Wick Road intersects the southern

portion of the Jockey Hollow Unit. Western Avenue penetrates the park from the north, becoming part of the park's tour loop road once inside the government boundaries.

Morris County is situated in what is described as the Highlands section of NJ, approximately 1,200 feet above sea level and is comprised primarily of the following deciduous forest types: mixed oak, sugar maple-hardwood, hemlock-hardwood, and chestnut oak (Natural History Information Service 1975). The park also contains 121.9 acres of open fields and a mixture of wetlands including one permanent pond, numerous seeps, and a half-mile section of the Passaic River. These forested areas are underlain by Precambrian gneiss and granite rock and Mesozoic siltstone, shale and sandstone sedimentary rock below the extension of late Wisconsinan glaciation, the last glaciation to affect New Jersey (Division of Science and Research 1996). These rock foundations are among the oldest in New Jersey, formed between 1.3 billion and 750 million years ago, and collectively create valleys flanked with high ridges and an erosion resistant environment resulting from the Precambrian rocks (Division of Science and Research 1996).

As part of the Great Swamp Watershed (a subunit of the Passaic River Watershed), some of the headwaters of MORR wetlands originate within the MORR boundaries while others originate on private land, thus activities occurring on the residential properties surrounding the park could influence the herpetofauna and their habitat as much as activities on park property does.

LAND USE HISTORY

Historically, the land included within MORR boundaries has been used as croplands, pastures for grazing livestock, and woodlands for harvesting wood and sustaining soldiers during General Washington's encampment in 1779 - 1780 (Ehrenfeld 1982). Forested areas were cleared as early as 1740, with the settlement of the first New Jersey residents, but then again on a larger scale by General Washington, which marked the first major disturbance to the land. Between Washington's encampment and the 1937 establishment of the land as a National Historical Park there was no extensive forest clearcutting, other than those areas previously cleared being maintained for varying purposes (Ehrenfeld 1977).

The initial succession of the cleared lands back to forested lands can be seen in the increase of boundary trees (trees previously left as boundary markers) and tree species within Morris County. Between 1750-1800 there were 6 species represented in 16 total trees, as compared to 11 species among the 34 total boundary trees in 1982 (Ehrenfeld 1982). Comparing early land deeds with those from subsequent years demonstrates the change in species composition along with an

increase in succession within the Jockey Hollow Unit. Deeds acquired before 1800 had approximately 75% xeric oaks (black and white oak) and hickory and only 12% of mesic and chestnut trees. Conversely, land described in subsequent deeds were only 25% xeric oaks, but were 38% mesic red oaks and chestnut trees. Overall, the more recent documents indicated greater species diversity than the earliest deeds (Ehrenfeld 1982).

As of 1930, just prior to the National Historical Park status, the majority of the forested land was older than 60 years, with a smaller allotment maintained as non-forested grasslands, pastures, crop fields, or orchards (Ehrenfeld 1982). With the 1937 declaration of the land as a National Park, came a cessation to any remaining agriculture practices. However, some areas were preserved as open lands and maintained for historical purposes and appearances (Ehrenfeld 1982).

There were other events that occurred, affecting the species composition at MORR. Between 1968 - 1970 defoliation by gypsy moths (Ehrenfeld 1977) resulted in substantial oak mortalities (approximately 22 trees per hectare). These mortalities were isolated in patches, resulting in little to no affect on seedling and sapling species composition. Another influence in the woody plant composition was the introduction of exotic species. In 1977 of the 94 species identified within park boundaries, 24 were non-native species; a statistic much higher than documented in any other central New Jersey forest. These species were primarily introduced for aesthetic purposes on plantations, indicating another modification to the landscape prior to the established protection of this land (Ehrenfeld 1977). In fact, the most abundant species, according to a 1982 study conducted by Ehrenfeld, is *Robinia pseudacacia* (Black locust), a species exotic to New Jersey.

CURRENT LAND USE PRACTICES

The majority of MORR land is managed passively, with appearance, history, and species control being the primary factors. Each of the six fields used as sample sites in this project are mowed for various reasons including plant control, promotion of wildlife use, aesthetic importance, and overflow parking. These fields are mowed on a frequency of once every two years to four times a year, depending on the aforementioned factors (Appendix 2). For the remaining wetland and woodland areas throughout the park, passive management is standard. With the exception of minimal exotic plant removal, there is a hands-off mentality towards the manipulations of habitats, to allow the land to change and develop through natural occurrences (Bob Masson 2000). Among

the species that are occasionally removed from the park are Japanese barberry (*Berberis thunbergii*), siebols uiburnum (*Uiburnum seboldii*), and oriental bittersweet (*Celastrus orbiculata*).

HERPETOFAUNA

A list of species expected to inhabit MORR (Appendix 3) was obtained through water resources studies, natural history observations, and general observations. The herpetofauna has not been formally documented at MORR. In 1983 Mele and Mele evaluated stream water quality and sampled biota, listing numerous reptile and amphibian species. Breck Kent (1980), a historical photographer, also reported herpetofauna found in MORR while photographing the park. This is the most comprehensive species list to date. NPS staff and regular visitors have reported other species. Various species are uncommon and prone to misidentification. For this reason there is a possibility of confusion among species, and some of the species previously documented are considered questionable.

TARGET SPECIES

Through these aforementioned studies and reports, a list of expected species was compiled. There remains a lack of sufficient documentation of population sizes or distributions within the park and in general snake populations are inadequately documented. Of particular importance are the many species that are listed as federal and state Endangered (E), Threatened (T) or Special Concern (SC) species, including *Clemmys insculpta* (wood turtle, T), *Eurycea longicauda* (long-tailed salamander, T), *Ambystoma laterale* (blue-spotted salamander, E), and *A. laterale* x *A. jeffersonianum* complex (Tremblay's salamander, E) (Behler 1999).

METHODS

The methods used in this inventory include a variety of general herpetological survey techniques. Different methodologies were used to gain an accurate representation of species composition by targeting specific taxa and/ or life stages. Using an assortment of methods provides more expansive information concerning the species that inhabit certain areas and whether or not they are using these wetlands specifically for breeding. This will allow us to better assess habitat usage by each species and thus identify critical habitats for federally listed species. The methods described here were devised by Behler and Cook (1999) and are subdivided into the various sampling techniques. Locations of these sites can be referenced by map (Appendix 4) and GPS

locale of traps and coverboards were recorded (Appendix 5). Data sheets for each method can also be referenced (Appendix 6).

Amphibian Calling Counts

During the amphibian breeding season, calling surveys were conducted to determine and record the presence or absence of anurans at specific pond and wetland sites. Many anurans are difficult to observe during the day and visit the wetlands at night to call and mate. Therefore, these calling surveys were conducted after sunset to optimize the chances of documenting all anuran species utilizing each site. Ten minutes were spent at each of four wetland sites recording species, listening to and identifying calls, and their call index of abundance. Anuran calls detected at locations other than designated survey sites, both inside and outside park property, were also recorded under general observations. Amphibian calling counts were performed twice during each of March, April, May and June.

Total Search Effort: 8 counts (10 minutes) per wetland throughout the spring for 4 sites = 32 counts

Egg Mass Counts

Counts of amphibian egg masses were conducted during March and April in pond and wetland seep locations. Egg masses were identified and enumerated.

Total Search Effort: Complete counts of egg masses at 4 wetland locations.

Time Constrained Search

Time constrained searches (TCS) were conducted in stream, pond, woodland, and field habitats. Covering as much of the habitat as possible, searchers focused under best available ground cover (thick leaf litter, large logs, and rocks) for an amount of time specified for that habitat location. The time allotted for each site allowed the sites to be sampled more or less proportionately, based upon size and difficulty within each habitat to encounter the species likely to occur there.

Stream Habitats - Six distinct stream or river sections were searched for amphibians and reptiles during March, April, May, June, August, and September. Searches were conducted by

hand and with a small dipnet, focusing under rocks and logs in streams and on stream edges. All sites were searched once during the sampling period with the exception of the Passaic River where searches occurred three times per sampling period. This was in effort to document the presence of *Clemmys insculpta* (T). Stream sections were divided as follows:

- Passaic River - 0.5 mile segment within the New Jersey Brigade Unit (1hr search, three times/ sampling period)
- Lower Primrose Brook - Jockey Hollow Unit, from confluence of West and East Primrose Brook, south to park boundary (1hr search/ sampling period)
- East Primrose Brook - Jockey Hollow Unit (1hr search/ sampling period)
- Upper West Primrose Brook - Jockey Hollow Unit, segment north of Jockey Hollow Road (1hr search/ sampling period)
- Lower West Primrose Brook - Jockey Hollow Unit, section from Jockey Hollow Road, south to confluence with East Primrose Brook (1hr search/ sampling period)
- Jersey Brook - Jockey Hollow Unit (0.5hr search/ sampling period)

Total Search Effort: 7.5 hours/ month for 6 months = 45.5 search hours.

Pond Habitats - Pond TCS were conducted at night targeting amphibians during periods of maximum activity. Each of the five pond habitats was searched for 0.5 hr per sampling period in March, April, May, June, August, and September. Ponds were surveyed by walking next to the water's edge. Investigators avoided entering the pond when possible to minimize any disturbance to the species and habitat. Flashlights and spotting scopes were used to identify herpetofauna, using dipnets when necessary. Surveyed wetlands are described below:

- Cat Swamp Pond - Jockey Hollow Unit, permanent pond
- Cattail Marsh - Jockey Hollow Unit, spring red marsh
- Seep Below Trail Center - Jockey Hollow Unit, seep running parallel to Lower West Primrose Brook
- Old Channel - New Jersey Brigade Unit, vernal pool adjacent to Passaic River

Total Search Effort: One 0.5 hr search/ wetland/ month for 6 months = 12 search hours

Woodland Habitats - Six terrestrial (non-riparian) woodland habitats were examined for one hour each per sampling period in March, April, May, June, August and September. The sections searched are as follows:

- Woodland Section #1 - New Jersey Brigade Unit, west of the Passaic River
- Woodland Section #2 - New Jersey Brigade Unit, east of the Passaic River

Woodland Section #3 - Jockey Hollow Unit, north of Jockey Hollow Road and west of Grand Parade Road

Woodland Section #4 - Jockey Hollow Unit, north of Jockey Hollow Road and east of Grand Parade Road

Woodland Section #5 - Jockey Hollow Unit, south of Jockey Hollow Road and west of Old Camp Road Trail

Woodland Section #6 - Jockey Hollow Unit, south of Jockey Hollow Road and east of Old Camp Road Trail

Total Search Effort: One hour search/ woodland/ month for 6 months at 6 sites = 36 search hours.

Field Habitats - Field TCS were conducted at six sites beginning at 10am and 3pm during April, May, June, August, and September. Field searches targeted terrestrial turtle and snake species. Fields were surveyed as follows:

Mt. Kemble Field - 13.5 acres within Jockey Hollow Unit (1hr/ sampling period)

Jarvis Field - 42.9 acres within New Jersey Brigade Unit (1hr/ sampling period)

Maryland Brigade Field - 6.7 acres within Jockey Hollow Unit (0.5hr/ sampling period)

New York Brigade Leech Field - 0.8 acres within Jockey Hollow Unit (0.5hr/ sampling period)

Wick Farm North Field - 6.4 acres within Jockey Hollow Unit (0.5hr/ sampling period)

Sugar Loaf Field - 1.8 acres within Jockey Hollow Unit (0.5hr/ sampling period)

Total Search Effort: 4 hours/ month for 5 month = 20 search hours.

Coverboards

Coverboards were placed in linear arrays of six: three 2' x 4' sections of 0.5" thick plywood, alternated by three 2' x 4' corrugated sheet metal. Coverboards were placed over existing vegetation, 5 m apart, in field and woodland habitats. Field arrays were situated along the woodland edge. Corn kernels were scattered under each coverboard to attract rodents to lure snakes, the primary species of focus for this technique. It was also expected that juvenile *Notophthalmus v. viridescens* (red-spotted newt) and other recent amphibian morphs would be found under coverboards located near ponds. Coverboards were checked twice per sampling period during the months of April, May, and June and checked three times during August and September. When possible, coverboards were not checked at the same time each time within the same sampling period. If coverboards were checked in the morning the first time, then they were checked in the afternoon the subsequent time. Coverboard locations are described as follows:

Field arrays:

Mt. Kemble Field - two arrays
Jarvis Field - two arrays
Maryland Brigade Field - one array
New York Brigade Leech Field - one array
Wick Farm North Field - one array
Sugar Loaf Field - one array

Woodland arrays:

Woodland #1 - one array
Woodland #2 - one array
Woodland #3 - one array
Woodland #4 - one array
Woodland #5 - two arrays
Woodland #6 - two arrays

Total Search Effort: A total of 1152 coverboard checks will be made from April to September.

Crab Traps

Wire traps (12"x12"x24", mesh 0.5"x1") baited with sardine cans were used to sample for small aquatic and semi-aquatic turtles. Traps were set and checked for periods of five consecutive days during April, May, and June. Two traps total were set at MORR, both along the bank of the Passaic River.

Total Search Effort: 8 trapnights/ month for 3 months = 18 total traphours.

Minnow Traps

Wire mesh (0.5") minnow traps were set with air space in pond and seep habitats during March, April, May, June, August and September. Traps were set and checked for at least five consecutive days per sampling period and were expected to yield adult and larval anurans and salamanders, specifically *Ambystoma*, and *Nerodia s. sipedon*. Traps were set at the following sites:

Cat Swamp Pond - three traps
Cattail Marsh* - three traps
Seep Below Trail Center - four traps
Lower Primrose Brook Seep* - three/ two traps
Indian Grave Brook Seep* - three/ one traps
Old Channel - three traps
Ephemeral Pond* - three traps/ zero traps

*Traps were either moved to a different location within wetland or removed from a site completely during the inventory (original/ actual).

Total Search Effort: 68 trapnights/ month for 6 months = 408 total traphours.

Hoop Traps

D-shaped metal hoops with 1" nylon mesh funnels were used in deeper sections of Cat Swamp Pond to inventory for small to large aquatic turtles. Five hoop traps were set and baited with sardines, around the pond, for periods of one week. Traps were set in May and June and checked daily.

Total Search Effort: 20 trapnights/ month for 2 months = 40 total traphours.

Incidental Encounters/ Observations

Any herpetofauna encountered (either seen or heard) while moving between sample locations, during trapping, or while no formal search was being conducted were recorded under general observations. Observations made by park staff were similarly recorded or noted when confirmation of questionable species could not be made.

RESULTS

A total of 7 salamander species, 6 anuran species, 5 turtle species, and 4 snake species were observed (Appendix 7):

Common Name	Species Name
SALAMANDERS	
Northern red salamander	<i>Pseudotriton r. ruber</i>
Northern dusky salamander	<i>Desmognathus f. fuscus</i>
Northern two-lined salamander	<i>Eurycea bislineata</i>
Eastern red-back salamander	<i>Plethodon cinereus</i>
Northern slimy salamander	<i>Plethodon glutinosus</i>
Spotted salamander	<i>Ambystoma maculatum</i>
Red-spotted newt	<i>Notophthalmus v. viridescens</i>
ANURANS	
Bull frog	<i>Rana catesbeiana</i>
Green frog	<i>Rana clamitans melanota</i>
Pickerel frog	<i>Rana palustris</i>
Wood frog	<i>Rana sylvatica</i>
Eastern american toad	<i>Bufo americanus</i>
Gray tree frog	<i>Hyla versicolor</i>
SNAKES	
Eastern garter snake	<i>Thamnophis s. sirtalis</i>
Northern ringneck snake	<i>Diadophis punctatus edwardsii</i>
Northern water snake	<i>Nerodia s. sipedon</i>
Eastern milk snake	<i>Lampropeltis t. triangulum</i>
TURTLES	
Eastern box turtle	<i>Terrapene c. carolina</i>
Eastern painted turtle	<i>Chrysemys p. picta</i>
Snapping turtle	<i>Chelydra s. serpentina</i>
Common musk turtle	<i>Sternotherus odoratus</i>
Wood turtle	<i>Clemmys insculpta</i>

A total of seven salamander species were observed during this survey. As expected, the most observed salamander species was *Plethodon c. cinereus*, totaling 388. Most of these observations were made during woodland TCS. *Eurycea bislineata* (323 observations) and *Desmognathus fuscus* (316 observations) were also commonly seen during stream TCS. *Notophthalmus v. viridescens* was recorded 90 different times and *Pseudotriton r. ruber* was recorded 71 different times. *Ambystoma maculatum* (12 observations) were documented only in

minnow traps. Eight observations of *Plethodon glutinosus* under coverboards and within woodland and stream habitat were made.

A total of six anuran species were recorded during this survey (including a single vocal observation of *Hyla versicolor* off park property). The park supports an abundant population of *Rana clamitans melanota*, as the most observed frog species, found around and within pond habitats, wetland seeps, and stream areas. Incidentally calling count exercises only yielded one adult of this species. *Rana palustris* observations were made scattered throughout the park, with most frequent observations around Cat Swamp Pond and Cattail Marsh. Visual encounters of *Rana catesbeiana* occurred 50 times within MORR, while 25 adult and juvenile *Bufo americanus* were observed throughout woodland areas. Though there are no previously documented population numbers for these species, it is known that they have inhabited MORR within the past 20 years based upon general observations made by Breck Kent and Mike Anderson (Kent 1980; Anderson 2000).

Only one state listed species was observed during the efforts of this inventory. *Clemmys insculpta* were found in and around the Passaic River on both MORR property and the adjacent Sherman-Hoffman land of the New Jersey Audubon Society. During this survey, a male and female were each marked. The female was observed twice more by Mike Anderson, a naturalist with the NJ Audubon Society. In 1999 Anderson (2000) found one carapace and captured two other individuals in the vicinity of the Passaic River. He marked both live individuals by carapace notching, therefore a total of four turtles in this population are marked for identification. Wood turtles were not found at any other location on or near park property.

Terrapene c. carolina (eastern box turtle) was the most frequently observed turtle species at MORR, with 15 individuals encountered throughout the sampling season. Most *T. c. carolina* were collected in Jarvis Field, in the southeastern section of the New Jersey Brigade Unit. There were no recaptures made this season. A few of the turtles captured had four shallow slash marks on both left and right pectoral scutes of the plastron. These markings are suggestive of a previous capture. There are no formal records of box turtle surveys conducted at MORR. Though no juveniles were captured, both males and females were identified during this survey.

There was only one individual observed each of the other turtle species identified for MORR (*Chrysemys p. picta*, *Chelydra s. serpentina*, and *Sternotherus odoratus*). Both the *Chrysemy p. picta* and the *Sternotherus odoratus* were captured with a crab trap in the Passaic River and were

recaptured there at least once more during the season. The *C. s. serpentina* was recorded three times during incidental encounters was located in Cat Swamp Pond.

Of the snake species expected to inhabit MORR, four were recorded. Most often seen was *Thamnophis sirtalis* (91 observations) and *Nerodia sipedon* (45 observations). These were the only snake species encountered during TCS. The remaining snake species (*Diadophis p. edwardsi*- 13 and *Lampropeltis t. triangulum*- 4) were seen as incidental encounters or under coverboards.

DISCUSSION

In its entirety, the herpetofauna of MORR has noticeably declined, not only in species composition, but also in population sizes, when compared with observations in the past. *Hemidactylus scutatum*, a species of abundance when Kent photographed MORR, requires mature forests, near marshy or bog areas with an abundance of sphagnum moss (Conant 1998; Petranksa 1998; Pfingsten 1989). Kent recalls seeing this species underneath clumps of sphagnum moss in and around Cattail Marsh, which he described as being a pond habitat, a foot deep with water. When this inventory commenced in March, Cattail Marsh had little to no water and was primarily mud with no evidence of sphagnum moss. Further descriptions from Kent (2000) indicate that the total area of the marsh also decreased in the past twenty years. There was one questionable observation of *Hemidactylus scutatum*. This was a larval form captured at Trail Center Seep and it was unable to be verified.

Though both adult and larval *A. maculatum* were captured this season, they were not observed in the hundreds that Kent recalls between 1978-1980. These observations were made in both Cattail Marsh and Cat Swamp Pond. Numbers may have declined in Cat Swamp Pond in result of the introduction of fish to that area.

In addition, Kent (1980) included *Eurycea l. longicauda* (long-tailed salamander), *Gyrinophilus p. porphyriticus* (Northern spring salamander), *Ambystoma opacum* (marbled salamander) and *A. jeffersonianum* (Jefferson's salamander) in his list of observations for the Cattail Marsh area. He found both *E. l. longicauda* and *G. p. porphyriticus* in the stream section north of the marsh, towards the Grand Parade sections (Appendix 4). It is important to note that *E. l. longicauda* is listed by New Jersey as a threatened species and was not observed during this inventory. Both *Ambystomid* species inhabited the marsh in the late 1970's (Kent letter 1980) and again were not detected in this survey. It is possible that when this survey was initiated in late March, that these two *Ambystoma* species had already congregated around the breeding ponds and

then retreated to the woodland habitats after breeding. In fact, in one Ohio study, *A. jeffersonianum* eggs were detected as early as 9 February and the beginning of March (Pfingsten 1989). However, no other evidence (egg masses or salamander larvae and morphs) of either of these two species was detected later in the season. Among the species that were collected at Cattail Marsh during this inventory is *Pseudotriton r. ruber*. Method of capture was minnow traps, while two older adult *P. r. ruber* were also observed approximately 10 meters south of the pond on a cool, rainy morning.

Among the other amphibian species that Kent (2000) recognized in great abundance in the 1970's are *Pseudacris crucifer*. Cattail Marsh, Trail Center Seep, and Lower Primrose Seep wetland habitats appeared suitable for populations of this species. Each of these wetlands is semi-permanent and surrounded by woodlands, both seeps containing trees and bushes in and near the water. All of these characteristics are preferred habitat for spring peepers (Conant and Collins 1998). However, these wetlands dried up almost completely by mid-August and Cattail Marsh became increasingly overgrown with *Microstegium uimineum* (Japanese wire grass), a non-native species. Mike Anderson (2000), the resident naturalist with the New Jersey Audubon Society in Bernardsville, reports observing *P. crucifer* a couple of times this year on the Sherman-Hoffman property, where there are no significant wetlands. In addition, the Great Swamp National Wildlife Refuge also reports hearing and seeing a plethora of spring peepers this year (Arnold 2000), indicating that individuals remain in this area of NJ. However, because no formal studies have been conducted within the park, it cannot be stated that there have been noticeable population fluctuations of *P. crucifer* on MORR property since Kent observed them here in the late 1970's. John Arnold (2000), a Fish and Wildlife biologist with the Great Swamp NWR, commented that though calling frogs were detected later than usual in the spring of 2000, he and his colleagues have observed no significant fluctuations in the population of spring peepers from previous years.

Anderson also notes that *Hyla versicolor* are detected each year on the Sherman-Hoffman land, but were only encountered once during this inventory, calling off Tempe Wick Road at the main entrance to the park, late in the spring. This species was not observed or heard again at any other site on or immediately around the park. Several years ago, the Sherman-Hoffman land supported a population of *H. versicolor* in and around a small, artificial structure resembling a child's pool behind their offices. This small pool was removed and the number of tree frogs typically observed declined almost entirely (Anderson 2000). Again, this is a species frequently observed and heard at the Great Swamp Wildlife Refuge (Arnold 2000). There is no substantial

information regarding habitat changes or disturbances in recent years other than a major drought in 1998-1999. It can be concluded that if this drought were a direct cause to the lack of spring peeper or gray tree frogs observed on MORR property, then there should also have been variations in the population sizes at the Great Swamp NWR. This, however, was not the case. Because there are no documented descriptions of habitat features from previous years, it is difficult to conclude that there has or has not been any changes in the wetland or woodland habitats that might affect MORR herpetofauna, past and present. Other than Kent's few comments regarding the Cattail Marsh area, none of the people contacted during this project recall any major or significant disturbances or changes to MORR habitats, that could affect populations in this manner.

It is important to note here the differences in the wetlands between the three protected areas. The Great Swamp NWR consists primarily of marshy, saturated habitats, with little to no surrounding woodland areas, while the Audubon Society land has no vernal pools or seeps, the only wetland being the Passaic River running through the property. Simply considering the available vernal habitats at each of these sites, the Great Swamp NWR should be able to support the largest population of *P. crucifer* and the Audubon land the smallest, as they need vernal pools for breeding activity (Conant 1998). *P. crucifer* should likewise inhabit the vernal pools and seeps throughout MORR, though this does not correspond with the observations made during this survey.

Other species records from MORR and the Sherman-Hoffman property include *Coluber c. constrictor* (Northern black racer), *Storeria d. dekayi* (Northern brown snake), and *Lampropeltis t. triangulum* (milk snake) as snakes inhabiting the area (New Jersey Audubon Society). Of those three, only *L. t. triangulum* was detected in this inventory, and then not until the end of the season, with the first individuals captured in early September; all were found under Mt. Kemble Field coverboards. Though the other two snake species were not observed during this field season, it again cannot be said that they do not inhabit these areas. The *Coluber c. constrictor* being an especially swift and elusive species may have detected the researcher and fled before being observed. In addition, two of the field habitats, Mt. Kemble Field and Jarvis Field, had very thick, tall vegetation (primarily grass species). This amount of vegetation cover often prevented capture and identification of snake species as they slipped rapidly through the vegetation.

Of the four snake species found during this inventory, *Thamnophis s. sirtalis* and *Diadophis punctatus edwardsii* were the most prevalent throughout the entire season, with both adult and juveniles of each of these species observed. In general, coverboard arrays in the field at the woodland edge seemed to attract more snakes than woodland arrays, though no statistical analyses

were conducted to confirm this conclusion. Coverboard arrays will remain in woodland and field habitats throughout the winter, to be checked again next season when the microhabitat created by the coverboards are better suited to attract snakes, in the hopes of detecting more snake species inhabiting MORR. It is possible that more snake species inhabit MORR that simply went undetected during this inventory. Coverboards may not have been set early enough in the season to allow the microhabitat to sufficiently attract snakes. It is suggested that if coverboards are used in subsequent years to survey specifically for snake species, they should be placed in woodland and field habitats several months before snakes are expected to utilize them. The longer the coverboards remain in the same location, the more decomposition of vegetation occurs underneath, creating a microhabitat better suited for snakes than when coverboards are initially set. This inventory has begun to create a baseline list of snake species, which can be expanded as the park continues to monitor and document confirmed herpetofauna observations.

There are several plausible causes for the discrepancy in species composition and numbers historically versus this year: increase in deer populations, increase in population of an invasive worm species, increase in exotic plants on the property, poor water quality, or outbreaks of an iridovirus affecting local populations. It was speculated that an increase in predatory birds could have factored into amphibian declines, however, Anderson (2000) informed us that there is no longer any bird species that are likely to prey upon the herpetofauna, and in fact he had observed a decrease in some birds of prey.

Beginning around 1980, deer populations began and have continued to rise at a destructive rate (Masson 2000). As the deer population continues to rise, they increase the browseline, affecting field habitats. In addition, they decrease the woodland understory, which in turn contributes to a drying out of the soil, creating serious repercussions to those herpetofauna that depend on a moist substrate. Exotic worm species may be similarly affecting the soil environment. Unpublished studies by Margaret Carreiro (2000) indicate that the non-native worm species inhabiting this area are decreasing the amount of leaf litter at a rapid rate, again increasing the dryness of the soil. The combination of deer and worm populations to decrease the woodland understory and leaf litter means that both reptiles and amphibians would have less cover under which to retreat from predators and harsh weather conditions. They would consequently be more susceptible to predation by aerial and terrestrial predators in addition to lethal affects from winter weather. Thus, an increase in worm activity one year might be associated with an increased mortality rate in herp populations in subsequent years (Carreiro 2000).

This inventory did not attempt to correlate any water quality data with the species composition, past or present, at the park. It would be a valuable piece of information to statistically analyze any apparent correlations between the water quality and chemical features of each of the wetlands and the species composition found at each site. Without such information, it cannot be determined what characteristics of the habitat might be directly affecting the species within the park and contributing to the decline of species and in populations.

A 1998 surface water report revealed that many of the wetlands across the park contain bacterial contamination. These wetlands include Primrose Brook (the main, east and west tributaries), Jersey Brook, Indian Grave Brook, and the Passaic River. In 1986 and 1989 the level of fecal coliform exceeded that of state and federal standards in the surface waters of the MORR. Then in 1995 the headwaters to Primrose Brook West were closed due to high levels of fecal contamination; the septic system located on the upslope of the brook was replaced, though the old system was never removed, and thus remains there. There was another septic system located northeast of Indian Grave Brook (Berger 1998). These systems could very well affect the herpetofauna around the park, as they are highly susceptible to chemical changes in the ground and surface water.

Much of the Primrose Brook runs throughout MORR property and is considered among the least polluted of the Great Swamp Watershed, being less influenced by human activity than other wetlands (Morristown National Historical Park 1993). This, in all probability, contributes to the greater number of salamander species found along the various branches of this brook in comparison with the number of salamander species yielded in the other stream surveys. The Passaic River is denoted as FW-2 Trout Maintenance Waters, meaning that water quality standards have been established for temperature, pH, dissolved oxygen, and bacterial quality among other measures (Berger 1998). It is unclear, however, how often the river is tested for these various standards. It would be important to evaluate and compare more closely the species composition and habitat quality between each site.

Finally, there is the increasing global concern that infectious diseases are a causal factor in amphibian declines. Diseases such as chytridiomycosis and ranavirus have been implicated in die-offs of amphibian populations across the globe, including throughout North America (Daszak 2000). It is suspected that iridoviruses are the cause in mass deaths of *Ambystoma maculatum** in 1998 in Maine (Daszak 2000) and die-offs of *Pseudacris crucifer* of Acadia National Park, Maine in June of 2000 (USGS 8 Aug. 2000). Such diseases can affect individual populations or entire

herpetofauna communities. With current concerns regarding worldwide declines in amphibian and reptile populations, the loss of any species is an issue, and becomes more so when combined with the loss of several other species. It cannot be said with complete certainty that species mentioned in this report have been lost from MORR, simply because they were not observed or detected during this study. Long-term, multi-year studies are needed to demonstrate any such trends or loss of populations and to help discern the most probable causes of such trends and losses.

*This report used *Ambystoma maculatum* and Tiger Salamander synonymously. It can be concluded as *Ambystoma maculatum* since the range of the Tiger Salamanders does not extend north of Long Island, NY.

Management Suggestions

There are several suggestions that can be made toward the management of MORR from findings of this study. These suggestions are made primarily to protect the natural occurrences of herpetofauna in the park. They include speed control on the Tour Loop Road, fish removal, and retention of the natural habitats that exist within park property.

It is suggested that more speed limit signs be posted along Tour Loop Road, which runs through the middle of the park. Due to the road kill found this season and the mobility of amphibians and reptiles during the spring and summer months, it is also suggested that speed bumps be constructed intermittently along this road. This would help to decrease the speed with which visitors drive through the park and consequently the volume of animals found dead on the road, while preventing any increased burden to law enforcement rangers who patrol the park.

It is also suggested that the fish in Cat Swamp Pond be removed. It is known that many amphibian species cannot survive in a fish laden wetland. Many fish prey upon amphibian egg masses, larvae, and even morphs becoming a limiting factor for amphibian inhabitants (Pough 1998) by preventing successfully reproduction in these ponds. Because humans introduced the fish in Cat Swamp Pond within the last twenty years (verbal communication, Masson 2000), it is valid to speculate that this introduction of fish likely contributed to the decline in species observed in and around Cat Swamp Pond. Removing the fish from Cat Swamp Pond could cultivate a more suitable habitat for species that have seen a decline in numbers, such as Ambystomid species. A list of fish

species inhabiting MORR wetlands will be added to the appendix, upon completion of a fish inventory report by Martha Mather.

Of immediate concern to the MORR herpetofauna is the proposed development of a large meeting center and an assisted care living center on lands adjacent to MORR. The meeting center is being proposed by the Girl Scouts of America and development could extend right up to the park's boundary (Masson 2000). The assisted living center would be located around the intersection of Sugar Loaf Road and Jockey Hollow Road, near Western Avenue. Both development projects are contingent upon the approval of sewage extensions (Masson 2000). As habitat destruction is a threat to salamander populations (Pfingsten 1989), this development would have a serious impact on both the amphibian and reptile populations within the park. Like any other development, this would increase erosion in the area, depleting the substrate where many species seek cover. Such erosion can create ground water contamination, which would be detrimental to amphibian populations.

In consideration that some herpetofauna utilize both aquatic and terrestrial habitats, they are important indicators of environmental quality. Morphologically the semi-permeable skin of amphibians makes them more susceptible to changes in their environment than other vertebrates, and they are often among the first species to show signs that habitats or ecosystems are changing (Pough 1998). While reptiles and amphibians represent 25% of all known extant vertebrate species, (Pough 1998) the critical habitats for these orders are not defined or documented. This information is imperative when considering the preservation of any species within the larger ecosystem, as each plant and animal species are intricately associated and the loss of habitat for one species inevitably results in the loss of other species. These factors are especially significant given the current worldwide decline that herpetofauna have been experiencing in recent years. The world has seen losses not only of local populations of individual species, but even in the disappearance entire communities (Pough 1998). Given these concerns, it is critical to evaluate our protected habitats and the species these habitats support. This means establishing long-term surveys to continue monitoring species known to inhabit these areas, while increasing our understanding of the habitat requirements necessary for the ecosystem to continue to support these species.

[illegible]

Access to the Jockey Hollow Encampment Area from I-287 is via exit 30 and U.S. 202 near Bernardsville. Turn right or north on U.S. 202 and follow the brown and white signs to the encampment area.

Appendix 2: Mowing frequency of fields at MORR:

FIELDS	ACRES	MOWING FREQUENCY
1. WICK APPLE ORCHARD REASON FOR MOWING	12.3 For aesthetics and to keep deer from entering garden	2-4 times per year May-Sept.
2. WICK FIELD WEST REASON FOR MOWING	1.7 For aesthetics	maximum 2 times/year May-Sept.
3. SOLDIER HUT REASON FOR MOWING	7.4 New field appearance and aesthetics	2-4 times per year May-Sept.
4. GRAND PARADE REASON FOR MOWING	1.8 New field appearance grass kept relatively short	2-4 times per year May-Sept.
5. ESTATE ENTRANCE REASON FOR MOWING	8,4.3,.4,1.1(4 areas) Parking area for trail and aesthetics	2-4 times per year May-Sept.
6. VISITOR CENTER LEACHFIELD REASON FOR MOWING	2.9 Plant control	Once a year, August-September
7. WICK FIELD,NORTH REASON FOR MOWING	6.4 Promote wildlife use and control woody plants	Once a year, August-September.
8. SUGAR LOAF FIELD REASON FOR MOWING	1.8 For possible overflow parking and aesthetics	Once a year, August-September.
9. NEW YORK BRIGADE LEACH REASON FOR MOWING	.8 Plant control	Once a year, August-September.
10. MARYLAND BRIGADE REASON FOR MOWING	6.7 Aesthetics and woody plant control	Once a year, August-September.
11. ROUTE 202 REASON FOR MOWING	1.6 Aesthetics and fire control	Once a year, August-September.
12. ADMINISTRATION ANNEX REASON FOR MOWING	2.6 Aesthetics and plant control	Once a year, August-September.
13. MOUNT KEMBLE REASON FOR MOWING	13.5 Woody plant control	Once every two years,Aug-Sept.
14. STARK'S BRIGADE REASON FOR MOWING	5.7 Woody plant control	Once every two years,Aug-Sept.
15. JARVIS REASON FOR MOWING	42.9 Old field appearance and woody plant control	Once every two years,Aug-Sept.

ACREAGE MOWED
 2-4 times/year 37 acres once/year 22.8 acres once every 2 years 62.1 acres = total acreage mowed 121.9 acres

NUMBER OF AREAS MOWED
 2-4 times/year 7 areas once/year 7 areas once every 2 years 3 areas = total acreage mowed 15 areas

NPS/WCS Amphibian-Reptile Inventory in New England Cluster of Northeast Region
MORRISTOWN NHS

Salamanders- 14 species		MORR	Status*	Basis for inclusion/Comments
Common name	Scientific name			
Marbled salamander	<i>Ambystoma opacum</i>	X		Kent 1980
Jefferson salamander	<i>Ambystoma jeffersonianum</i>	X		Kent 1980, Mele and Mele 1983 reports are questionable
Blue-spotted salamander	<i>Ambystoma laterale</i>	Questionable		
Blue-spotted-Jeff. sal. complex	<i>A. laterale-jeffersonianum complex</i>	Questionable		
Spotted salamander	<i>Ambystoma maculatum</i>	X		Kent 1980
Red-spotted newt	<i>Notophthalmus v. viridescens</i>	X		Kent 1980 in cattail marsh, Mele and Mele 1983
Northern dusky salamander	<i>Desmognathus fuscus</i>	X		Kent 1980, Mele and Mele 1983
Eastern red-backed salamander	<i>Plethodon c. cinereus</i>	X		Kent 1980, Mele and Mele 1983, NH obs. 1991 and 1993
Northern slimy salamander	<i>Plethodon glutinosus</i>	X		Kent 1980, Mele and Mele 1983, NH obs 1991
Four-toed salamander	<i>Hemidactylium scutatum</i>	X		Kent 1980
Northern spring salamander	<i>Gyrinophilus p. porphyriticus</i>	X		Kent 1980
Northern red salamander	<i>Psuedoeurycea r. ruber</i>	X		Kent 1980, NH obs. 1991, 1993
Northern two-lined salamander	<i>Eurycea bislineata</i>	X		Kent 1980, Mele and Mele 1983
Long-tailed salamander	<i>Eurycea l. longicauda</i>	X	T	Kent 1980

Frogs- 8 species		MORR	Status*	Basis for inclusion/ Comments
Common name	Scientific name			
Eastern american toad	<i>Bufo a. americanus</i>	X		Kent 1980, NH obs 1991
Northern cricket frog	<i>Acris c. crepitans</i>	X		Kent 1980
Gray treefrog	<i>Hyla versicolor</i>	X		Kent 1980, calling cattail pond?
Northern spring peeper	<i>Pseudacris c. crucifer</i>	X		Kent 1980,
Bullfrog	<i>Rana catesbeiana</i>	X		Kent 1980, calling cattail pond, Mele 1981 cat swamp pond
Green frog	<i>Rana clamitans melanota</i>	X		Kent 1980, widespread. Mele 1981 cat swamp pond
Wood frog	<i>Rana sylvatica</i>	X		Kent 1980, NH obs. 1991, 1994
Northern leopard frog	<i>Rana pipiens</i>	X		Kent 1980, Mele and Mele 1983, Mele 1981 Cat swamp Pond
Pickrel frog	<i>Rana palustris</i>	X		Kent 1980, Cattail swamp and cat swamp pond

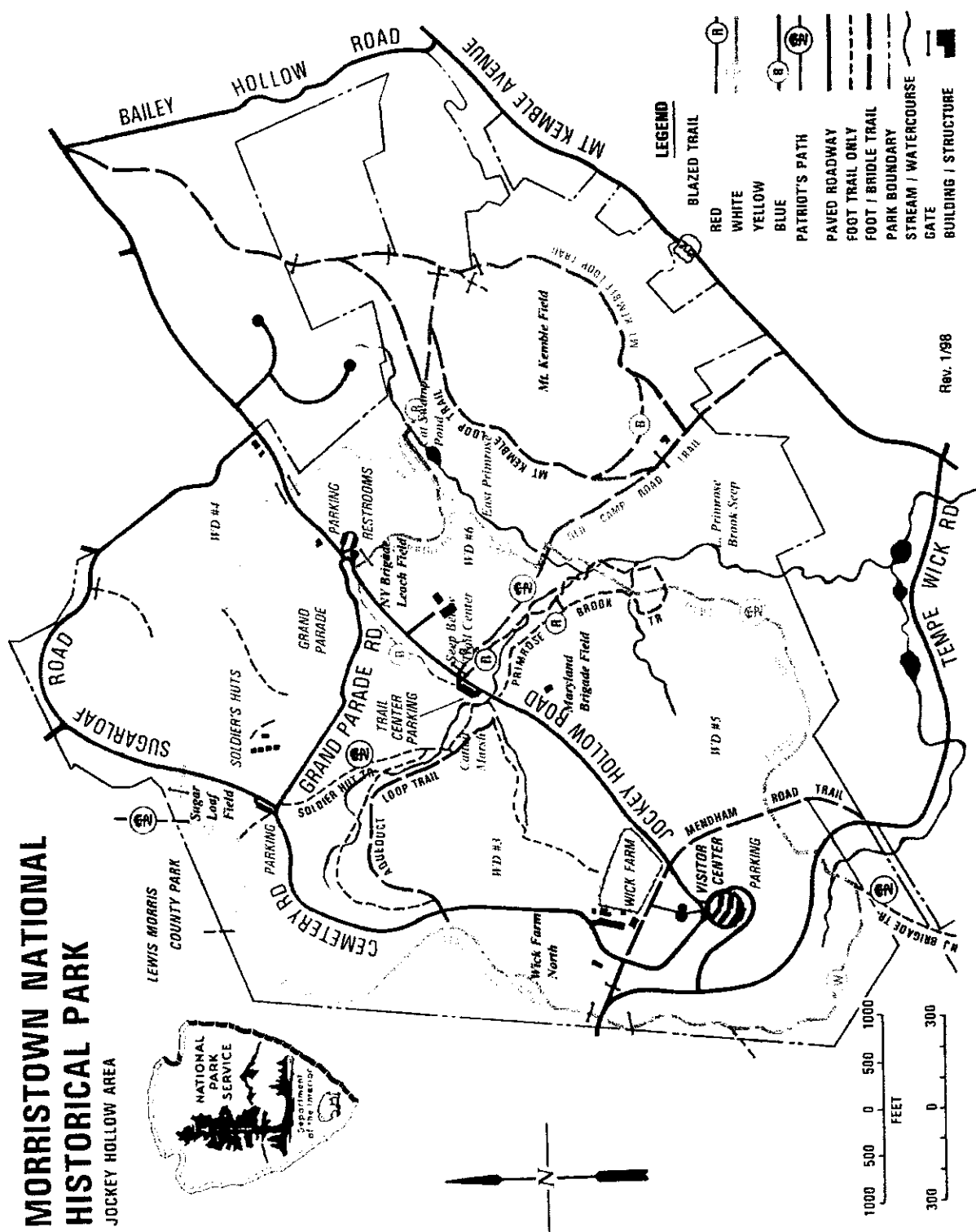
*S- Species of Special Concern, T- Threatened Species, E- Endangered Species

Turtles- 4 species		MORR	Status*	Basis for inclusion/ Comments
Common name	Scientific name			
Snapping turtle	<i>Chelydra s. serpentina</i>	X		park list reports as common, Cat Swamp Pond
Wood turtle	<i>Clemmys insculpta</i>	X	T	RMP 1998 states several recent records, expected in Passaic River listed for adjacent Scherman Hoffman sanctuary
Eastern box turtle	<i>Terrapene c. carolina</i>	X		Mele and Mele 1983, NH obs. 1990, 1991, 1994
Eastern painted turtle	<i>Chrysemys p. picta</i>	X		NH obs and list, cat swamp pond 91, cross estate

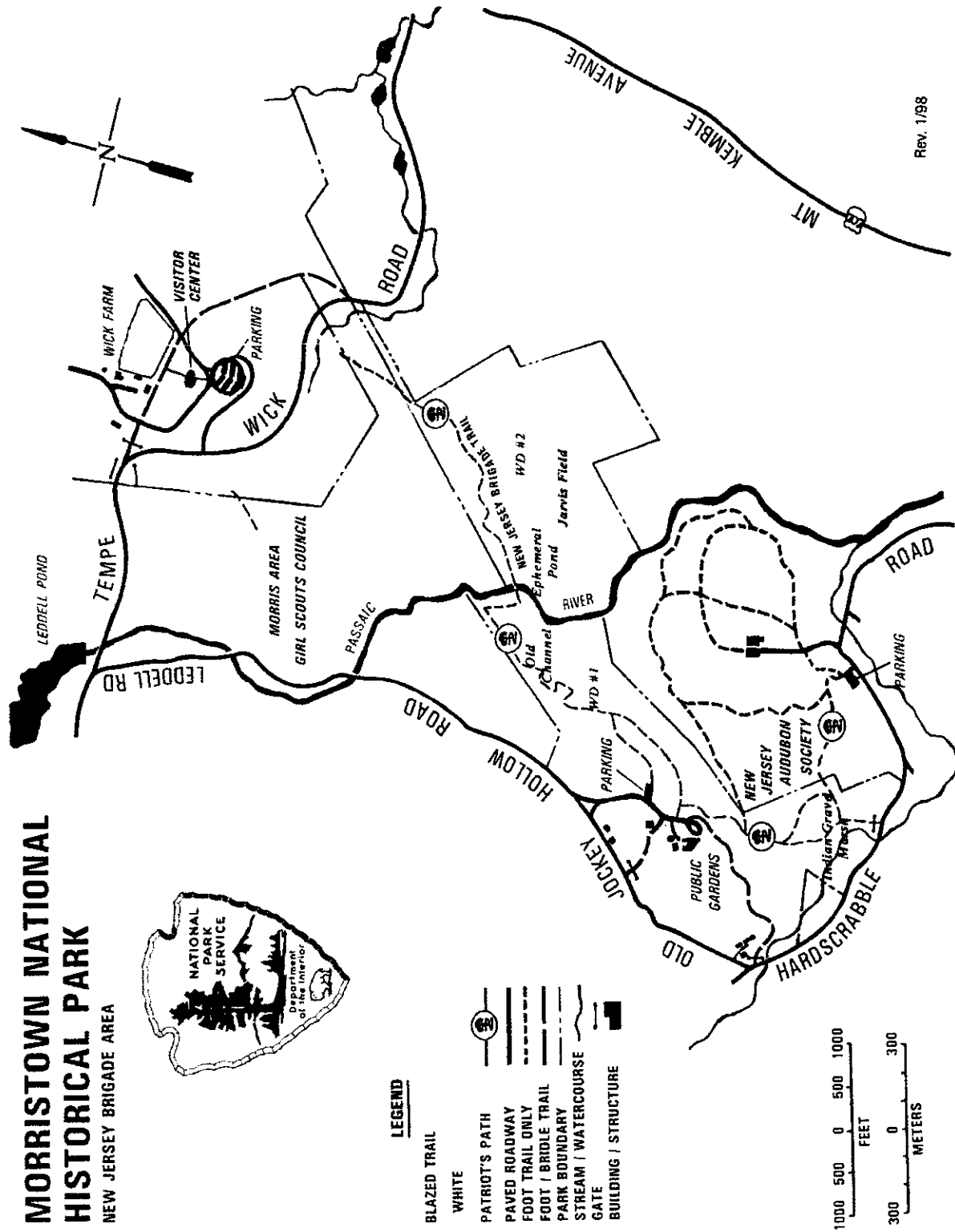
Snakes- 7 species		MORR	Status*	Basis for inclusion/ Comments
Common name	Scientific name			
Northern water snake	<i>Nerodia s. sipedon</i>	X		Mele and Mele 1983, NH obs. 1991, west primrose park list says is common
Eastern ribbon snake	<i>Thamnophis. s. sauritis</i> ○	Questionable		reported 1983, would not accept without verification
Eastern garter snake	<i>Thamnophis s. sirtalis</i>	X		Mele and Mele 1983, NH obs. 1990 and 1991, west primrose park list says is common
Eastern milk snake	<i>Lampropeltis t. triangulum</i>	X		reported 1984
Northern ringneck snake	<i>Diadophis p. edwardsii</i>	X		NH obs. 1980 Wick Orchard, list 1993, Jockey Hollow Maintenance
Northern black racer	<i>Coluber c. constrictor</i> ○	X		listed for adjacent Scherman Hoffman sanctuary
Northern brown snake	<i>Storeria d. dekayi</i> ○	X		listed for adjacent Scherman Hoffman sanctuary

*S- Species of Special Concern, T- Threatened Species, E- Endangered Species

Appendix 4: Identified sampling sites (property of MORR):



Appendix 4 (cont.):



Appendix 5: GPS locale of traps and coverboards:

Location	Samp. Tech.	Trap #	Utm X	Utm Y	UtmXStop	UtmYStop
Cat Swamp Pond	HT	88	540052	4513075		
	HT	89	540059	4513083		
	HT	90	540050	4513074		
	HT	91	540031	4513062		
	HT	92	540032	4513040		
	MT	59	540051	4513076		
	MT	65	539992	4513063		
	MT	76	540014	4513067		
Cattail Marsh	MT	63	539219	4512962		
	MT	64	539222	4512963		
	MT	66	539208	4512974		
Seep Below Trail Center	MT	62	539356	4512988		
	MT	68	539392	4512890		
	MT	74	539409	4512911		
Lower Primrose Brook	MT	67	539720	4512485		
	MT	70	539705	4512485		
Indian Grave Brook Seep	MT	60	537061	4509914		
Old Channel	MT	72	537777	4510873		
	MT	75	537770	4510877		
	MT	77	537761	4510877		
Passaic River	CT	79	537781	4510880		
	CT	80	537794	4510938		
Mt. Kemble Field	CB	43-48	540428	4512703	540441	4512681
		49-54	540496	4512865	540488	4512840
Jarvis Field	CB	73-78	538530	4511225	538537	4511194
	CB	79-84	538557	4511051	538538	4511027
MD Brigade Field	CB	37-42	539129	4512564	539108	4512584
NY Leach Field	CB	25-30	539751	4513303	539736	4513284
Wick Farm North Field	CB	1-6	538471	4512753	538473	4512779
Sugar Loaf Field	CB	13-18	539046	4513875	539032	4513914
Woodland #1	CB	91-96	537296	4510690	537315	4510687
Woodland #2	CB	85-90	538480	4511243	538454	4511247
Woodland #3	CB	7-12	538686	4512612	538676	4512639
Woodland #4	CB	19-24	539820	4513789	539820	4513824
Woodland #5	CB	61-66	540089	4512184	540068	4512180
		67-72	538947	4512054	538975	4512070
Woodland #6	CB	31-36	539693	4513294	539681	4513276
	CB	55-60	540448	4512896	540439	4512922

Appendix 6: Data sheets utilized in study

National Park Service and Wildlife Conservation Society Wisconsin Frog and Toad Survey- Field Data Sheet

Amphibian Calling Counts

Park:

Observer's Names:

Date:

Time Begin:

Time End:

Weather**:

Wind:

Sky:

Air Temperature:

Water Temperature:

CALL INDEX*	
SITE NAME:	
1) E. Spadefoot Toad	
2) American Toad	
3) Fowler's Toad	
4) U. Chorus Frog	
5) Spring Peeper	
6) N. Cricket Frog	
7) Gray Treefrog	
8) Wood Frog	
9) Pickerel Frog	
10) N. Leopard Frog	
11) S. Leopard Frog	
12) Green Frog	
13) Bull Frog	

all Index:

- 0- No calls
 1- Individuals can be counted, space between calls
 2- Calls of individuals can be distinguished but there is some overlapping, intermediate
 3- Full chorus, calls are constant, continuous and overlapping

Weather Codes:

Sky:	Sky Condition:	Wind:	Indicators of wind speed:
Code #:		Code #:	
0	Clear or few clouds	0	Smoke rises vertically
1	Partly cloudy/variable	1	Wind direction shown by smoke drift
2	Cloudy (broken) or overcast	2	Wind felt on face; leaves rustle
3	Fog	3	Leaves and small twigs in constant motion;
4	Drizzle		wind extends small flag
5	Showers	4	Raises dust and loose paper; small branches are moved

ments (difficulties, background noise levels, uncertain calls, habitat changes since previous run):

TE NOTES

NPS/WCS Cooperative Agreement Amphibian and Reptile Survey

VERNAL POOL SURVEY

Park: Pool #: Topo Quad:

Pool Location: UTMx UTMy +/-
 GPS Datum: NAD83/UTM Zone 18 Receiver Model & #:

Date: Time:

Observers (1) (2) (3)

Pool description:
 Max. Depth: Approx. Size: pH:
 Pool Veg:
 Surrounding Veg:

Species

Individuals/Calling Index

	Egg Masses	Adults	Larvae
<i>Ambystoma maculatum</i>			
<i>Ambystoma opacum</i>			
<i>Ambystoma jeffersonianum</i>			
<i>Notophthalmus viridescens</i>			
<i>Pseudacris crucifer</i>			
<i>Rana sylvatica</i>			
<i>Rana clamitans</i>			
<i>Rana palustris</i>			
<i>Rana catesbeiana</i>			

Notes:

Park Name:

Date:

Start time:

End Time:

Weather:

Clear

Sunny <50% cloudy

Cloudy >50% cover

Hazy

Overcast

Drizzle

Rain

Snow

Sleet	
-------	--

Calm

Int.breeze

Stead. Wnd

Very windy >3 mph

Air Temperature:

Water temperature:

Comments:

Collecting Locality:

GPS Data

Sampling Technique:

Hand Collection, Time Constrained Search, Cover Board, Minnow Trap, Crab Trap,
Hoop Trap, Amphibian Calls, Egg Counts, Seining, Road Collecting

Number Traps Set:

[illegible][illegible][illegible]

#Capt/Calling

Species

Sex	Age	Weight	Height	Waist	Waist:Height	Waist:Weight	Waist:Weight:Height
Male	20	70	175	35	0.20	0.005	0.00028
Male	25	75	180	38	0.21	0.005	0.00029
Male	30	80	185	40	0.22	0.005	0.00030
Male	35	85	190	42	0.22	0.005	0.00030
Male	40	90	195	45	0.23	0.005	0.00031
Male	45	95	200	48	0.24	0.005	0.00032
Male	50	100	205	50	0.24	0.005	0.00032
Male	55	105	210	52	0.25	0.005	0.00033
Male	60	110	215	55	0.26	0.005	0.00034
Male	65	115	220	58	0.26	0.005	0.00034
Male	70	120	225	60	0.27	0.005	0.00035
Male	75	125	230	62	0.27	0.005	0.00035
Male	80	130	235	65	0.28	0.005	0.00036
Male	85	135	240	68	0.28	0.005	0.00036
Male	90	140	245	70	0.29	0.005	0.00037
Male	95	145	250	72	0.29	0.005	0.00037
Male	100	150	255	75	0.30	0.005	0.00038
Male	105	155	260	78	0.30	0.005	0.00038
Male	110	160	265	80	0.31	0.005	0.00039
Male	115	165	270	82	0.31	0.005	0.00039
Male	120	170	275	85	0.32	0.005	0.00040
Male	125	175	280	88	0.32	0.005	0.00040
Male	130	180	285	90	0.33	0.005	0.00041
Male	135	185	290	92	0.33	0.005	0.00041
Male	140	190	295	95	0.34	0.005	0.00042
Male	145	195	300	98	0.34	0.005	0.00042
Male	150	200	305	100	0.35	0.005	0.00043
Male	155	205	310	102	0.35	0.005	0.00043
Male	160	210	315	105	0.36	0.005	0.00044
Male	165	215	320	108	0.36	0.005	0.00044
Male	170	220	325	110	0.37	0.005	0.00045
Male	175	225	330	112	0.37	0.005	0.00045
Male	180	230	335	115	0.38	0.005	0.00046
Male	185	235	340	118	0.38	0.005	0.00046
Male	190	240	345	120	0.39	0.005	0.00047
Male	195	245	350	122	0.39	0.005	0.00047
Male	200	250	355	125	0.40	0.005	0.00048
Male	205	255	360	128	0.40	0.005	0.00048
Male	210	260	365	130	0.41	0.005	0.00049
Male	215	265	370	132	0.41	0.005	0.00049
Male	220	270	375	135	0.42	0.005	0.00050
Male	225	275	380	138	0.42	0.005	0.00050
Male	230	280	385	140	0.43	0.005	0.00051
Male	235	285	390	142	0.43	0.005	0.00051
Male	240	290	395	145	0.44	0.005	0.00052
Male	245	295	400	148	0.44	0.005	0.00052
Male	250	300	405	150	0.45	0.005	0.00053
Male	255	305	410	152	0.45	0.005	0.00053
Male	260						

Identification

Data Collector.

National Park Service and Wildlife Conservation Society Cooperative Agreement Amphibian & Reptile Survey				
Park:		Your Name:		
Date Observed (MM/DD/YYYY):		Address/Telephone/E-mail:		
Species:	#s	Time (24 hr):	Detailed Location/ GPS (UTM X, UTM Y, (+/-))	Codes:
1.				
2.				
3.				
4.				
5.				
*Please return all cards to: Park Visitor Center or Dept. of Herpetology, Wildlife Conservation Society, Bronx, NY 10460-1099, tel. (718) 220-5152				

VERIFICATION CODES	
Method of Documentation:	Type of Evidence:
CAP- hand-captured, trapped, netted and released after identified OBS- observed w/o capture PH- photograph VOC- frog vocalization VS- voucher specimen (permit holders only), include destination and accession # in "additional information"	DOR- dead on road KIL- any other carcass find BON- bones, shell SHD- snake shed EGG- eggs or egg masses NST- nest LRV- tadpole or larvae ADL- adults JUV- juveniles TRK- tracks
Other Observers:	
Notes (habitat, weather, behavior, index, misc. obs.):	

Appendix 7: Observations of survey

Species	GCO CI (GC) CB				TCS			Method				Totals CI	
	1,2,3	Metal	Wood	Wood	Field	Stream Pond	CCI	EM	HT	CT	MT		Totals- Ind. Obs.
<i>Ambystoma maculatum</i>							1,2,3						
<i>Notophthalmus v. viridescens</i>	2										12	12	
<i>Desmognathus fuscus</i>	14				3		42				46	90	
<i>Plethodon c. cinereus?</i>	76				307	5	293				2	316	
<i>Plethodon glutinosus</i>		2	2		3	1						8	
<i>Pseudotriton r. ruber</i>	11				4	30	3				23	71	
<i>Eurycea bislineata</i>	24				3	295	1					323	
<i>Bufo a. americanus</i>	21			1	3							25	
<i>Hyla versicolor</i>		1*0,5*											01*0,5*
<i>Rana catesbeiana</i>	33	0,1*0				1	14	1,0,0			2	50	1,1*0
<i>Rana clamitans melanota</i>	697	9,2,0			5	27	816				311	1856	9,2,0
<i>Rana sylvatica</i>	4					1						5	
<i>Rana palustris</i>	145				5	1	19	144			69	413	
<i>Chelydra s. serpentina</i>	3											3	
<i>Sternotherus odoratus</i>	1									5		6	
<i>Clemmys insculpta</i>	3											3	
<i>Terrapene c. carolina</i>	4				1	10						15	
<i>Chrysemys p. picta</i>							1			1		2	
<i>Nerodia sipedon</i>	33					5	2				5	45	
<i>Thamnophis sirtalis</i>	47	20	14		1	7	1	1				91	
<i>Diadophis punctatus edwardsii</i>	2	3	8									13	
<i>Lampropeltis t. triangulum</i>			4									4	
Unknown	9											15	
Salamander						6	20					20	
Tadpole							5				1	6	
Frog						1	4					5	
Snake						2						2	
Sheds			2	1		1						4	
Key: GCO- Green Card Observations CB- Coverboards CCI- Calling Count Index HT- Hoop Trap													
CI (GC)- Calling Index, Green Card TCS- Time Constraint Search EM- Egg Mass Counts CT- Crab Trap													
MT- Minnow Trap													
* - observed off mark property													

MORR- Permanent Streams													
Species	Location, Methods												
	L. Primrose		L. W. Primrose		U. W. Primrose		E. Primrose		Passaic River		Indian Grave		Totals
	TCS	MT	TCS	MT	TCS	MT	TCS	MT	TCS	CT	TCS	MT	TCS CT MT
<i>Desmognathus f. fuscus</i>	51		50		74		46	46					26 293
<i>Plethodon glutinosus</i>					1								1
<i>Pseudotriton r. ruber</i>	7	1	4		11				8		5		30 6
<i>Eurycea b. bislineata</i>	39		49		60		29	104					14 295
<i>Rana catesbeiana</i>									1				1
<i>Rana clamitans melanota</i>	3	4	3		1		4	9			1	6	6 27 10
<i>Rana sylvatica</i>									1				1
<i>Rana palustris</i>	1						8	7					17
<i>Sternotherus odoratus</i>										5			5
<i>Chrysemys p. picta</i>										1			1
<i>Thamnophis s. sirtalis</i>												1	1
<i>Nerodia sipedon</i>			1						5				5 1
Unknown	2												6
Unknown salamander			4				4	6	1		3		1 20
Unknown frog			5				1						3 5
Unknown shed			1							1			1

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