

RECEIVED
GREAT SWAMP NWR
JUN - 7 1990

ANIMAL CONTROL
MANAGEMENT PLAN

Ref. Mgr. 1 _____
Ref. Mgr. 2 _____
Ref. Mgr. 3 _____
Ref. Mgr. 4 _____
O.R.P. _____
Biol. _____
Bio. Tech. _____
Sec. _____
Clrk./Typ. W _____
Maint. 1 _____
Maint. 2 _____

GREAT SWAMP NATIONAL WILDLIFE REFUGE
BASKING RIDGE, NEW JERSEY

Submitted: William Koch Date: 3-30-90
Refuge Manager

Reviewed: Paul Lichten Date: 4/19/90
Central Refuges Biologist

Reviewed: Yon Hunter Date: 4-3-90
Supervisory Regional Biologist

Reviewed: Donald N. Frickie Date: 5-29-90
Associate Manager - North

Approved: Charles H. Hays Date: 6-1-90
ARD - Refuges and Wildlife

TABLE OF CONTENTS

	<u>Page</u>
Part I. Plan Relation to Refuge Objectives	
A. Introduction	1
B. Acreage	2
C. Topography	2
D. Climatology	3
E. Soil Types	3
F. Vegetation Type Classification	3
G. Wildlife	
1. Endangered and Threatened Species	4
2. Other	4
H. Refuge Objectives	5
I. Obtaining Refuge Objectives	6
Part II. Resources Available, Current Program and Problem Description	
A. Banding History	7
B. Problem Description	9
Part III. Description of the Recommended Control Method	10
Part IV. Alternatives Considered	
1. Environmental Manipulation	12
2. Live Trapping and Transfer	12
3. Public Trapping	13
4. Non-lethal Repellents	13
5. Physical or Mechanical Barriers	13
6. Toxicants	14
Part V. Evaluation of Animal Control Program	14
Part VI. List of Contributors	15
Part VII. References Cited	15
Appendix 1. Threatened and Endangered Species Documented at Great Swamp NWR.	
Appendix 2. Historical Waterfowl Banding Locations	

Part I. Plan Relation to Refuge Objectives

A. Introduction

Great Swamp National Wildlife Refuge is a rich and productive ecological area. The refuge is relatively small totalling 6,971 acres and is situated within the Great Swamp Basin located in Chatham, Harding and Passaic Townships of Morris County in north central New Jersey. Morristown, the County Seat of Morris, is seven miles to the north and New York City is twenty-five miles to the east. Remaining lands in the basin are predominantly held in private ownership with the exception of Somerset County Park (854 acres) and Morris County (40 acres) parklands.

Creation of the Great Swamp began approximately 25,000 years ago when the Wisconsin Glacier stopped at its furthest point south and deposited sand and gravel in the only outlet of the Passaic Basin formed by the ancient Watchung Mountains. With the outlet plugged, the basin began filling with water. As the glacier retreated northward, its meltwater formed a huge lake called Lake Passaic that was 10 miles wide and 30 miles long. The retreating glacier eventually opened up a second outlet and as the lake drained, extensive areas of marshes and swamps were formed. The Great Swamp Basin, a remnant portion of the Lake Passaic Basin, is a shallow bowl seven miles long and three miles wide. This 14,000 acre basin is surrounded on all sides by low-lying ridges 50-200 feet high.

Great Swamp is located in the headwaters of the Passaic River Basin and is bordered on the west by the upper Passaic River. The Swamp drains 29.2 square miles of watershed northeast of Millington Gorge and receives waters of Primrose, Sawmill, Loantaka, Great and Black Brooks. In short, it drains all of the southern area of the Passaic River watershed above Millington Gorge. Great Swamp normally floods most years during spring runoff and occasionally during late summer hurricane rains; however, flooding in recent years is occurring more frequently and with greater magnitude due to the urbanization of the Great Swamp Watershed, and conversely low flows of tributaries which are lower during dry periods.

There have been various uses planned for the Great Swamp: flood control in the 1920's; drainage projects in the 1930's; and a jet airport proposal in 1959. It was the threat of the jetport which enabled the Great Swamp Committee of the North American Wildlife Foundation to muster the aid of a significant number of volunteers. This effort raised more than a million dollars to purchase nearly 3,000 acres which were donated to the Department of the Interior. These acres formed the nucleus of the Great Swamp National Wildlife Refuge. Through the years, additional acres have been added to the original tract bringing the refuge to its present 6,971 acres.

Approximately 2,351 acres within the approved refuge acquisition boundary are still in private ownership.

Extensive development throughout the 55 square mile Great Swamp Watershed is showing the characteristic signs of a watershed becoming urbanized. Negative impacts to the refuge and its wildlife are occurring. More and more impervious surfaces (roads, parking lots, driveways, roof tops, etc.), storm drains, channelized brooks and lost wetlands direct a greater volume of water into the swamp in a shorter period of time. Impacts to the refuge include increased erosion and siltation, pollutants, and greater magnitude and frequency of flooding. Conversely, during dry periods flows are significantly lower. Because the refuge is impacted by activities within 11 municipalities making up the watershed, refuge management at Great Swamp National Wildlife Refuge has in a way become watershed management, but with very little authority and control. Involvement by refuge staff and other Service personnel in issues and planning efforts off the refuge is becoming a more common and necessary occurrence.

Great Swamp is literally an island of wildlife habitat totally surrounded by suburban communities and rapidly encroaching urbanization. In the communities surrounding the refuge there are increasing problems with nuisance wildlife involving such species as raccoons, skunks, and woodchucks which are tolerable of human activity and adaptable to changes in land use. Frustrated residents occasionally live trap the nuisance wildlife and release it on the refuge. Unwanted pets including wildlife and domestic species are also released on the refuge. Occasionally adjacent neighborhood pets are unrestrained and roam onto the refuge. Great Swamp offers one of the last refuges for wildlife and wild habitats in northern New Jersey and becomes increasingly important to man and wildlife as other natural areas are destroyed.

B. Acreage

Swamp woodland, hardwood ridges, cattail marsh and grassland typify this 6,971 acre refuge. Predominant vegetation types within the refuge are 2,715 acres forest, 502 acres field, 597 acres brushland, 3,102 acres swamp, marsh and other wetlands, and 55 acres administrative land. This acreage may vary within types as additional land is acquired and habitat manipulations prescribed in other plans are effected.

C. Topography

Great Swamp is located in the Piedmont Plateau of the Appalachian Province. The Plateau and the area surrounding the Swamp is

characterized by gently rounded hills separated by broad valleys with hills rising from 200 to 400 feet above sea level.

D. Climatology

The climate of the area is basically "continental" although it is also influenced by the Atlantic Ocean. Moderately cold winters, defined springs and autumns, and warm, humid summers are typical. Temperature extremes range from -20°F to 100°F with a summer average of 80°F and a winter average of 30°F. The average growing season is 155 days. Spring frosts occur as late as mid-May while the first killing frost usually occurs in mid-October. Annual precipitation averages 48.38 inches and monthly average precipitation is 4.03 inches. The month of February usually has the least amount of precipitation at a normal of 2.96 inches and August the greatest amount at a normal of 5.23 inches.

E. Soil Types

Soils of the Great Swamp National Wildlife Refuge were formed in organic deposits and glacial lake sediment. The surface soils of the Swamp consist of sapric peats, mucks and loams of variable depths underlain by mineral soil materials. Almost all the refuge soils are deep and very poorly drained. The two major soil associations occurring on the refuge are described below:

Carlisle Muck: This soil is found in low swamp areas. The soil is a deep organic type that is fibrous and less decomposed than soil below a depth of 12 inches.

Parsippany Silt and Clay Loam: This soil, found on level ground, has a perched water table at or near the ground surface for long periods. Permeability and runoff are slow. Because of its low position on the landscape, the soil receives runoff from adjoining higher areas.

F. Vegetation Type Classification

Species of plants from both the northern and southern botanical zones are represented on the refuge. The refuge is characterized as a brush and timbered swamp with low ridges or knolls rising from five to 15 feet above the surrounding swamp. In several places, the swamp opens into small marshes. Bottomland vegetation is composed of ash, red maple, highbush blueberry, swamp rose, willow and a wide variety of ground cover types. Many of the low ridges support a forest association of beech, oaks, gray birch, sugar maple, black gum, white ash and shagbark hickory.

Marsh vegetation types vary. Predominant species include arrow-arum, pickerelweed, cattail, buttonbush, bur-reed, woolgrass, duckweed and smartweed in various combinations.

G. Wildlife

1. Endangered and Threatened Species

The bald eagle and peregrine falcon are two federal endangered species that are normally observed at least yearly on the refuge usually during migration. Fifteen other species found on the refuge are listed as threatened or endangered by the State of New Jersey (Appendix 1). Two great blue heron rookeries are present in refuge wetlands, and other listed species have been documented nesting on the refuge or seen during annual spring or fall migrations.

2. Other

Fish

Thirty species of fish (mostly warmwater) have been identified throughout the refuge. Fishing is not permitted on the refuge because opportunities are very limited and the activity would conflict with the refuge's primary objectives directed at waterfowl and other migratory birds. (See Great Swamp NWR Fisheries Management Plan for additional information.)

Amphibians and Reptiles

There are eighteen species of amphibians and twenty-one species of reptiles on the refuge. The blue-spotted salamander, bog turtle and wood turtle, State endangered or threatened species, are all dependent on high quality wetlands for survival.

Birds

Two-hundred-and-twenty-two (222) species of birds have been identified on the refuge. Specific refuge goals and objectives include providing migration and nesting habitat for waterfowl, especially dabbling ducks. Refuge wood duck management, a high priority program, intends to maximize production through habitat modification and increase the availability of nesting cavities. Migrating waterfowl are given equal priority. Attempts to manipulate water levels in impoundments are timed throughout the year in order to provide for the varying needs of waterfowl.

Mammals

Thirty-three (33) species of mammals have been identified on the refuge. Included are the white-tailed deer, cottontail rabbit, red and gray fox, raccoon, gray squirrel, muskrat, striped skunk,

woodchuck, opossum, mink and river otter. An annual white-tailed deer public hunt on the refuge is directed at preventing overpopulation of the herd. Objectives of the hunt include preventing habitat destruction from overbrowsing and maintaining a healthy herd.

H. Refuge Objectives

The following is a list of current refuge goals:

1. Manage the refuge in concert with regionally and nationally mandated objectives for species of special emphasis.
2. Achieve the maximum number of migratory bird species indigenous to the region consistent with other important management needs and habitat limitations.
3. Preserve habitat to ensure the perpetuation of as many other indigenous species as possible.
4. Restore and preserve the natural ecological balance of the 3,660-acre Wilderness Area in accordance with the Wilderness Act of 1964, the Great Swamp Wilderness Act of 1968, and Fish and Wildlife Service Wilderness Management Policy.
5. Provide a program of interpretation and environmental education that complements other non-refuge environmental education programs in the area and informs the public about other refuge management activities.
6. Provide opportunities and required facilities for high quality wildlife/wildlands recreation consistent with protection of the Great Swamp ecosystem and other administrative mandates and policies.
7. Monitor land use changes within the Great Swamp Watershed and develop and implement actions to mitigate related impacts to the refuge or to refuge programs.
8. Encourage scientific study and research by colleges, universities and qualified organizations which is directed toward fulfillment of refuge objectives.

This plan will describe planned animal control procedures to reduce nuisance raccoons that interfere with waterfowl banding on the refuge and hinder efforts to meet banding quotas that contribute to national, regional and station objectives.

I. Obtaining Refuge Objectives

Waterfowl banding in the United States and Canada serves several purposes designed to monitor species of ducks and geese by determining distribution of populations and harvest rates, changes in harvest rates, productivity and survival.

A major goal of the Great Swamp National Wildlife Refuge is to manage the refuge in concert with regionally and nationally mandated objectives for species of special emphasis. Monitoring species using survey techniques such as banding is important to evaluate management activities for these species. The Refuge Manual also states that some refuges may be designated to work on special wildlife surveys such as banding (7 RM 3.4).

On an international level, the North American Waterfowl Management Plan (NAWMP) has been established by the United States and Canada, and a similar agreement with Mexico is currently being negotiated. The NAWMP has far reaching goals of conserving and restoring lost wetland habitat and reestablishing waterfowl populations in North America to levels attained in the 1970's. One goal of the NAWMP is to restore the breeding duck population index to about 62 million that will produce a fall flight forecast of about 100 million ducks (USFWS and CWS, 1986). The current fall flight forecast for 1989 was only about 64 million (USFWS and CWS, 1989). Monitoring waterfowl populations through surveys and banding is crucial to determining the success of this plan.

The NAWMP has established Joint Ventures which involve cooperative working agreements between Federal, State and private wildlife agencies to address key issues in several critical areas identified in North America. The Great Swamp National Wildlife Refuge is situated within the Atlantic Coast Joint Venture which has established as one of its goals to restore black duck populations and migration and wintering habitat. Evaluation of these goals through surveys such as banding is again vital to determining the success of the Atlantic Coast Joint Venture.

All banding in the United States is directed by the United States Fish and Wildlife Service (USFWS) and in Canada by the Canadian Wildlife Service (CWS). The Atlantic Flyway Council, which is made up of representatives of Federal, State and private agencies from the United States and Canada, directs waterfowl banding throughout the flyway by establishing objectives, special studies and banding quotas. The USFWS regional offices further direct banding operations and coordinate banding effort between cooperators within their region to ensure an equitable distribution of banding effort.

The recently updated banding program (USFWS and CWS, 1989b) has set goals for banding throughout North America. The current overall

banding objectives in the United States and Canada are to:

1. Determine the distribution of harvest from various breeding and/or wintering areas, and to define breeding sources of birds harvested in a specific area.
2. Determine changes that may occur in harvests of various species.
3. Determine a measure of productivity of breeding populations.
4. Determine annual or long-term survival rates of specific populations.

The information for these objectives is determined from band recovery data, harvest rates , and by studying band recoveries for a period of years.

In 1959, a formal banding needs document for waterfowl was jointly written by the United States and Canada that outlined and coordinated banding objectives for both countries. This document has been updated about every five years to revise banding objectives for the next five years. The recently revised banding needs document written in 1989 gives banding objectives until about 1994 (USFWS and CWS, 1989c). According to this document, preseason banding is being emphasized over post-season banding. New Jersey has been assigned preseason banding quotas for black duck (500) and wood duck (750). Because of different banding objectives, New Jersey does not have a preseason quota for mallard but will contribute to the preseason banding quota of 3,000 mallard assigned to the Northeastern States. Banding quotas should not be considered a maximum level, but a minimum level necessary for data analysis. Great Swamp National Wildlife Refuge has a preseason banding quota of 200 wood ducks which is apportioned from the 750 quota for New Jersey.

In recent years, Great Swamp has banded most of the wood ducks during preseason banding in New Jersey and therefore makes a significant contribution to the banding quota for the State. For example, in 1988, the refuge banded 92 percent of all wood ducks banded in New Jersey (Ferrigno, 1988).

Part II. Resources Available, Current Program and Problem Description

A. Banding History

Great Swamp National Wildlife Refuge has had a waterfowl banding program since 1968. During the 1970's, banding success was extremely variable with a high of 482 (1972) and a low of one (1978) wood ducks banded. In general the banding period 1970-74 was very successful and gradually declined for the rest of the decade. Records indicate

that since 1980, the refuge has been assigned a preseason banding quota of 200 wood ducks. During the 1980's this quota has only been reached twice, in 1983 and 1988. Wood duck banding success continued to be highly variable in the 1980's and some of this variability may be due to changes in waterfowl populations, changes in banding personnel, or differences in banding effort and methods.

A variety of waterfowl trapping techniques have been tried over the years in an attempt to reach the banding quota. These methods included large stationary (permanent) swim-in traps, portable lilypad swim-in traps, confusion type (Montezuma) traps, floating platform traps, rocket netting, roost drives and capturing hens in nest boxes.

Historical banding sites (Appendix 2) on the refuge have utilized open water areas along dike roads in the Management Area and a few accessible open water locations in the Wilderness Area. In some cases, a small bulldozer was used to prepare banding sites by clearing thick emergent vegetation. In 1983, fourteen (14) banding sites were prepared using a bulldozer to scrape away vegetation a short distance into the water, and at some sites sand was added to improve the bottom for duck traps.

Portable swim-in or floating platform duck traps work the best based on the recent trapping history at Great Swamp. It has always been difficult to capture a large number of wood ducks at any one banding location, and success diminishes rapidly the longer traps are left at one site. At this station it has proven more successful to use a nomadic system of relocating waterfowl traps to a new location as trapping success at respective sites declines. During the usual preseason banding period, wood ducks and other waterfowl are not concentrated, but are generally dispersed throughout the refuge. Hens are concluding nesting, while other hens with young broods are spread out and concealed in thick cover. Vegetation becomes increasingly abundant, providing wide spread cover and alternate food sources.

Permanent swim-in traps involve more time to set up and are not cost effective unless large numbers of ducks can be captured at one or two locations. Confusion type (Montezuma) traps have worked well in capturing wood ducks in other areas, but have generally been unsuccessful at this refuge. It has been difficult to get substantial numbers of wood ducks to come onto land to use this type of trap, and Canada geese seem to find these traps and exclude other waterfowl from using the area. Similarly, rocket netting is difficult because baited areas on land do not attract sufficient numbers of wood ducks to justify its use.

Roost drives in wood duck roosting areas have been relatively unsuccessful at Great Swamp in the past. This method however, has been very successful in other areas, and may yet prove successful at

Great Swamp. Many factors can influence success in this method such as trap design, location and orientation, time of day, weather, drive procedures and number and experience of personnel. Roost drives are normally done in late summer when ducks are congregating in large numbers. Consideration should be given to the possibility that if the drive is not successful then it will probably be too late in the season to begin other waterfowl trapping techniques. Due to this risk it is recommended that other waterfowl trapping techniques be employed earlier in the season and a roost drive, if planned, is not relied upon to meet the entire banding quota.

Capturing wood duck hens in nest boxes has been used in the past, but has limited value in meeting the station banding quota. Only a few hens can be captured in this manner, while being a very time consuming method. Nest boxes must also be properly designed to accommodate this procedure and at this time many of the refuge duck boxes are not. This technique may also be a disruptive influence on incubating hens.

B. Problem Description

In recent history, raccoons have been a problem during waterfowl banding at Great Swamp. They frequently find baited areas within one or two days, and discourage ducks during the prebaiting period so waterfowl traps cannot even be set to capture ducks. Moving duck traps to new locations generally does not solve the problem, as raccoons quickly find the new sites. Raccoons are often habitual, and once they find a food source they will continue to visit the area. In 1986, eleven (11) raccoons were documented at a baited site at one time and all of the banding areas that year were found by raccoons. In addition to discouraging waterfowl use at trap sites, raccoons will also enter duck traps once they are set and kill the birds inside.

Raccoons are mostly nocturnal, but are also active in the early morning and late afternoon. Raccoons are omnivorous, consuming anything from fruits and berries to insects, frogs, bird eggs - and ducks. Raccoons do not hibernate but will den up during cold weather periods inside hollow logs, rock crevices or ground burrows. Their home range can be up to two miles, but generally is less than a mile. Young raccoons may move up to 165 miles from their place of birth, but in most cases dispersal is less than thirty miles (Burt and Grossenheider, 1976). Raccoons produce one litter a year and litter sizes range from two to seven. Young raccoons are born between April and May and remain in the nest for about two months, and then begin travelling with the female. Young of the year leave the female in the fall to find new territories.

Raccoon population densities have been estimated at one per acre

(Twichell and Dill, 1949), which is the highest density documented. Slate (1980) determined raccoon population densities in several rural and one suburban area in New Jersey which ranged from one raccoon per 43 acres to one raccoon per 4.5 acres. The one study area that was similar to Great Swamp was the suburban area, which averaged one raccoon per 6.8 acres for the period 1977 to 1979 (Slate, 1980). A mark-recapture study with raccoons on the refuge in the late 1970's determined the population density to be about one raccoon per 5 to 7 acres at that time.

A Furbearer Trapping Program to remove primarily muskrat and incidentally trapped raccoons was initiated on the refuge in 1975. Private trappers were selected by a drawing and from 1975 through 1977, only five (5) raccoons were captured incidental to muskrat trapping. The trapping program was discontinued in 1978. Due to an outbreak of sarcoptic mange in 1980, approximately thirty (30) raccoons were trapped and dispatched on the refuge and surrounding area. Since 1980, only a few raccoons were removed each year, and these were primarily nuisance animals trapped at the Wildlife Observation Center or at government quarters. In 1986, approximately eight (8) raccoons were dispatched at waterfowl banding sites. In 1988, a total of seventy-six (76) raccoons were removed from banding locations and in 1989, forty-one (41) raccoons were relocated away from waterfowl trap sites. In 1988, even with the raccoon trapping effort at banding sites, raccoons entered duck traps and killed two birds. Two ducks were also killed by raccoons in waterfowl traps in 1989. Waterfowl loss at banding sites would be much greater, along with much fewer ducks banded, if raccoons are not controlled around banding sites.

Part III. Description of the Recommended Control Method

Objective

The refuge banding program supports refuge, regional and national goals. The high frequency of raccoon interference at banding sites during waterfowl trapping and banding efforts is therefore unacceptable. Raccoons will be live-trapped at operational banding sites and dispatched by refuge personnel during the banding season.

Waterfowl Trapping Locations

Recent waterfowl trapping at this station has been nomadic, in that a number of potential banding sites are identified, but only a few are used at one time, and traps are moved to new locations when trapping success declines. There are approximately twenty-two (22) locations that have been used in the past for duck banding (Appendix 2). Some of the historical banding sites may no longer be suitable for

waterfowl banding due to changes in duck use, vegetation, accessibility and other factors. New banding locations may be identified, and an annual evaluation of potential waterfowl trap sites will be conducted prior to each banding season. Raccoon traps will be set in conjunction with selected banding sites and moved as banding locations change throughout the season.

Raccoon Trapping Procedure

Generally two box traps will be set at each operational banding location. Each box trap will be baited with either fresh fish, canned pet food or other types of bait. Box traps will be set in conjunction with waterfowl traps which includes a prebaiting period that may vary from several days to a week before the traps are set to catch ducks. During this prebait period, box traps will be set to capture any raccoons that are attracted to the baited site because these raccoons will discourage use by waterfowl. Raccoon traps will be checked twice a day during prebaiting. When waterfowl traps are set to catch birds the raccoon traps will be checked in conjunction with checking the duck traps.

Disposal of Carcasses

Raccoons caught in traps will be transported to an area on the refuge predetermined by the Refuge Manager, and dispatched in the box trap with a .22 caliber rifle. Captured raccoons will be quickly and humanely dispatched and the carcasses will be buried at locations within the management area designated by the Refuge Manager.

Personnel Qualifications

Raccoon trapping and disposal will be conducted by refuge personnel. All individuals involved with the program will receive proper instruction on safe handling and use of firearms. Also, all personnel will be advised on safe handling procedures and potential diseases associated with raccoons and other captured animals. A safety session will be given to all personnel prior to raccoon trapping.

Capture of Non-target Species

The target species for this program is raccoon. Other potential non-target wildlife species such as skunks, opossum, mink, river otter, and fox that may be incidentally captured will be released on site. It is unlikely that stray dogs will be caught in traps due to the size of the trap. If a dog is captured it will be turned over to

the local animal control officer. Stray or feral cats are more likely than dogs to be caught in traps, but the occurrence is anticipated to be very low. If a cat is captured, the local humane society or animal control officer will be contacted. If the humane society refuses to take the cat or an owner not found, it would be dispatched and buried in the same manner as raccoons.

Permit Requirements

The raccoon trapping program will meet all Federal and State permit and reporting requirements. The State of New Jersey requires that the refuge have a valid Special Wildlife Management Permit to capture and destroy raccoons. Only the use of live traps is authorized. An annual report will be submitted to the State by the end of January summarizing the trapping program for the preceding year.

Recording Data

A daily record of raccoon trapping will be maintained with information regarding trap location, capture date, species caught, and final disposition. A brief report summarizing the trapping program will be written and filed in the Trapping file (13.008).

Part IV. Alternatives Considered

1. Environmental Manipulation

There are no practical techniques to manipulate habitat to control raccoons other than by eliminating sources of food and shelter (Boggess, 1983). The food source attracting raccoons in this program is the bait needed to attract waterfowl and can not be eliminated. Raccoons use a wide variety of habitats throughout the refuge and adjacent private land and can find sources of food and shelter almost anywhere on the refuge. The objective of this plan is to reduce raccoon interference at waterfowl banding sites and no habitat manipulation method would be appropriate. A biological control of raccoons does not exist, and natural predators such as wolf and cougar have long been absent from this area.

2. Live Trapping and Transfer

Relocating raccoons away from banding sites would only be a temporary solution and could create additional problems in relocation areas. Raccoons travel and forage over a wide area, and some relocated animals would likely return to banding areas. Additional raccoons

transferred to other areas could cause increased agricultural depredation, nuisance to local homeowners, predation and disease transmission. Rabies moved into New Jersey in the Fall of 1989 and is expected to move eastward throughout the State, adding to the justification for not transferring and concentrating populations of raccoons.

3. Public Trapping

A public trapping program, whether done in conjunction with State seasons or during a special permit season, would not achieve the objective of removing nuisance raccoons from banding sites and a raccoon control program would still be needed during banding. A public raccoon trapping program during the State season between November and March might initially remove some raccoons from banding areas, but other raccoons would likely replace those removed during trapping and raccoon control would still be necessary during banding which usually starts several months later (July - September). A permitted public trapper, paid contractor or volunteer enlisted to remove raccoons during the banding program would cause additional disturbance at the waterfowl trap sites if their visit did not coincide with the refuge employee who maintains the waterfowl traps. There would also be little economic incentive for public trapping during the summer banding season due to the poor condition of the pelts. A public trapping program may have merits, but it is felt that the control program outlined in this plan is necessary regardless.

4. Non-lethal Repellents

Although several non-lethal repellents have been tried to discourage raccoon use in certain areas, only a few (most notably naphthalene) have been effective and only in closed areas. No compound has been found to repel raccoons in open areas. Frightening techniques have also been ineffective in repelling raccoons over a period of time and would interfere with the waterfowl trapping efforts if attempted.

5. Physical or Mechanical Barriers

Moving waterfowl traps further into the water away from land would create a water barrier that might inhibit some raccoons from reaching the traps. However, this would also complicate waterfowl trapping by increasing time at each trap, and additional equipment (i.e. canoe or rowboat) and personnel would be required. Physical exclusion by building barriers such as fencing is an effective control measure against raccoons in some situations. Completely enclosing an area with fencing has had some success in excluding raccoons, however

completely enclosing a waterfowl banding area would not be feasible. A fence along the shoreline may exclude some raccoons, but many would probably go through, over or around the fence. Wiring the fence with electricity enhances its effectiveness. An electric fence might be easier and less elaborate to construct, but would likely require more maintenance than a standard fence. An electric fence could be constructed on land along the water edge at banding sites and possibly be effective in reducing raccoon use at the site. Raccoons could still gain access by going around the fence. Since the banding program at Great Swamp requires relocating traps to numerous banding locations, fencing would have to be constructed at each site.

Also many banding sites would not be suitable for electric fencing. The cost of the banding program, both in materials and staff time, would be substantially increased using this exclusion method.

6. Toxicants

Fish and Wildlife Service policy permits the use of poisons only as a last resort when no other method is effective and a condition exists that will severely impact refuge objectives if a control measure is not implemented. Poisons are non-selective and nontarget species could be killed. There are currently no poisons registered for raccoon control. Toxicants are not recommended.

Part V. Evaluation of the Animal Control Program

The objective of the animal control program is to remove nuisance raccoons that are interfering with waterfowl trapping and banding operations. The success of the animal control program will be evaluated based on the presence or absence of raccoons at waterfowl banding locations. A successful animal control program will be determined by the absence of raccoons at waterfowl banding sites, thus reducing interference of raccoons during waterfowl trapping operations. The success of waterfowl banding in meeting or exceeding the quota of wood ducks and the banding of additional waterfowl, mainly black duck and mallard, may add support in the evaluation process of the animal control program, but will not be used as a criteria. Raccoon interference at waterfowl trapping sites is a major factor, but not the only one, influencing the banding program at Great Swamp. Yearly waterfowl population fluctuations, weather, trapping techniques, trapping effort and the number and experience of personnel all contribute to a successful banding program.

Part VI. List of contributors.

The following is a list of agencies or individuals contacted during the planning and writing of the Animal Control Plan.

Edwin Butler, U. S. Department of Agriculture, Animal and Plant Health Inspection Service.

Fred Ferrigno, Principal Wildlife Biologist, New Jersey Department of Environmental Protection, Division of Fish, Game and Wildlife.

George Haas, Migratory Bird Coordinator - Region 5, U. S. Fish and Wildlife Service.

Jerome Sere, Atlantic Flyway Representative, U.S. Fish and Wildlife Service, Patuxent Wildlife Research Station.

Part VII. References cited:

Bogges, E. K. 1983. Raccoons. In Prevention and Control of Wildlife Damage. R. M. Timm, ed. Great Plains Agriculture Council, Wildlife Resource Committee, University of Nebraska, Lincoln, NE.

Burt, W. H. and R. P. Grossenheider. 1976. A Field Guide to the Mammals. Howard Mifflin Co., Boston, MA. 289 pp.

Ferrigno, F. 1988. Bird Banding. New Jersey Dept. of Fish, Game and Wildlife. Pittman - Robertson Proj. W-58-R-12. Job I-C. 9 p.

Slate, D. 1980. A Study of New Jersey Raccoon Populations-Determination of the Densities, Dynamics and Incidence of Disease in Raccoon Populations in New Jersey. New Jersey Dept. of Fish, Game and Wildlife. Pittman - Robertson Proj. W-52-R-8. Final Report. 67 pp.

Twitchell, A. R., and H. H. Dill. 1949. One Hundred Raccoons From One Hundred and Two Acres. J. Mammal. 30:130-133.

U. S. Fish and Wildlife Service. 1982. National Wildlife Refuge System, Refuge Manual. Washington D. C.

U. S. Fish and Wildlife Service and Canadian Wildlife Service. 1986. North American Waterfowl Management Plan. Washington D. C. 19 pp.

- _____. 1989. 1989 Status of Waterfowl and Fall Flight Forecast. Washington, D. C. 39 pp.
- _____. 1989b. A Revised Approach to the North American Duck Banding Program. Washington D. C. 97 pp.
- _____. 1989c. Banding Needs Document. Washington D. C. 48 pp.

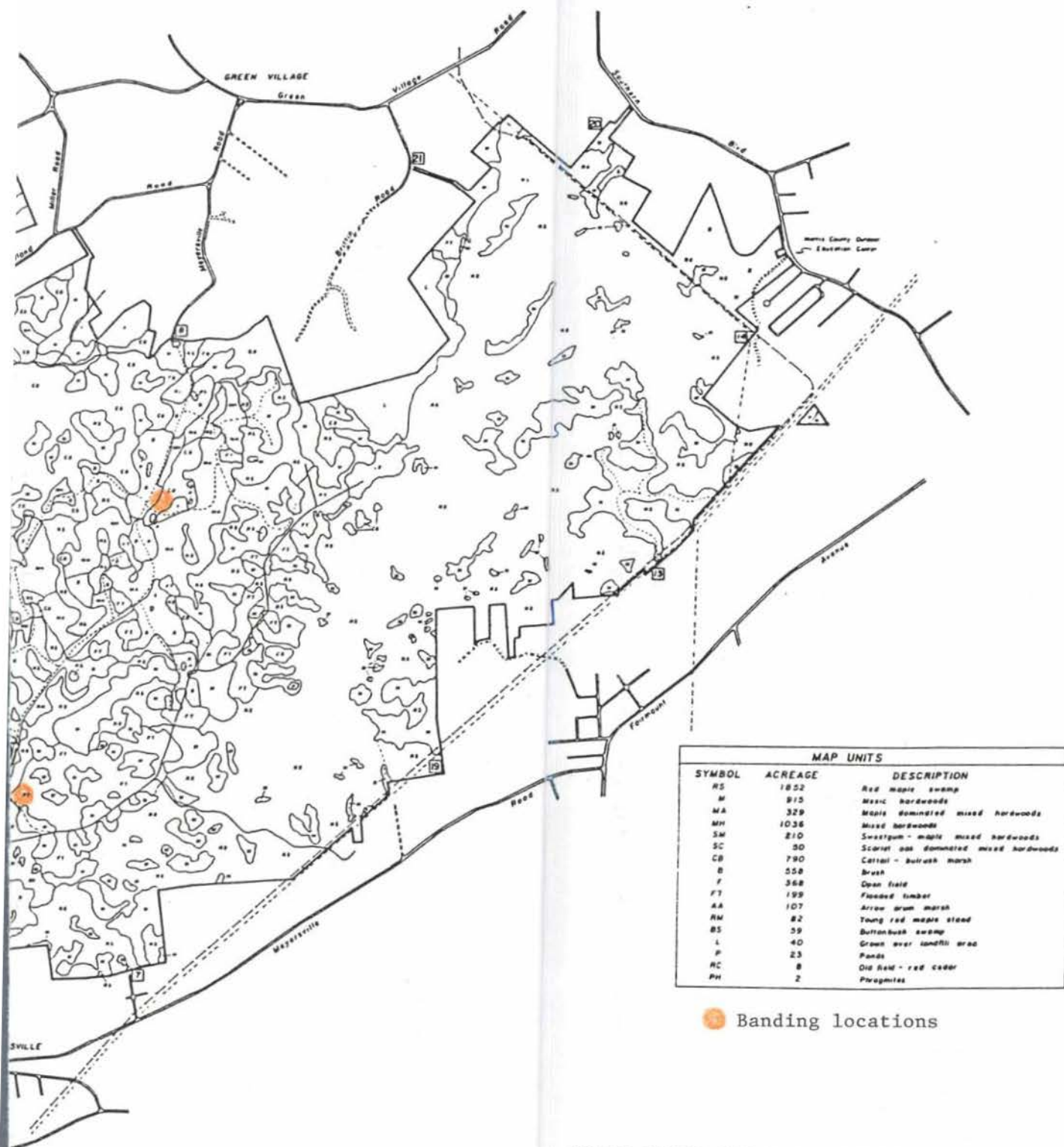
APPENDIX 1. Endangered or threatened species documented at Great Swamp N.W.R.

SPECIES	Federally Endangered	State Endangered	State Threatened	Only Breeding Population Endangered
Brook Trout			X	
Blue-Spotted Salamander		X		
Bog Turtle		X		
Wood Turtle			X	
Pied-Billed Grebe				X
Cooper's Hawk		X		
Northern Harrier				X
Bald Eagle	X	X		
Peregrine Falcon	X	X		
Upland Sandpiper		X		
Short-Eared Owl				X
Cliff Swallow				X
Loggerhead Shrike		X		
Vesper Sparrow				X
American Bittern				X
Great Blue Heron			X	
Yellow-Crowned Night Heron			X	
Osprey			X	
Northern Goshawk				X
Red-Shouldered Hawk			X	
Barred Owl			X	
Red-Headed Woodpecker			X	
Bobolink				X
Savannah Sparrow				X
Grasshopper Sparrow				X



LEGEND	
Refuge Boundary	=====
Improved Road	=====
Unimproved Road	-----
Cover Type Boundary	-----
Foot Trails	-----
Fish Boundary	-----
Power Line	-----
Pipeline	-----
Streams & Ditches	-----
Parking Lots	
Safety Zones	

APPENDIX 2. Historical banding locations
at Great Swamp N.W.R.



GREAT SWAMP NATIONAL WILDLIFE REFUGE
MORRIS COUNTY NEW JERSEY
REVISED SEPTEMBER 1985

NOTE: Refuge boundary taken from Great Swamp N.W.R.
Tract map dated December 1979
Cover types from natural color aerial photographs
taken March 21, 1979

Scale in feet
100 550 0 1100 2200 3300