Buffer Zones and Beyond

Wildlife use of Wetland Buffer Zones and their Protection under the Massachusetts Wetland Protection Act

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TABLE OF CONTENTS

APPENDICES

ABSTRACT

Massachusetts wetland regulations do not provide adequate protection to wetland buffer zones for wetland dependent wildlife. Buffer zones, or upland areas adjacent to water resources, provide essential habitat to 65 species of wetland dependent wildlife in Massachusetts and protect the water resources from adverse actions in adjacent areas. This represents 76% of the 86 species of freshwater wetland dependent wildlife in Massachusetts. This report demonstrates the lack of adequate protection for Massachusetts wetland wildlife habitat through the examination of 4 taxa (reptiles, amphibians, mammals and birds) and their dependency on the upland adjacent to freshwater wetlands. It documents these species use of the upland and the distances traveled into the upland. Wildlife use of upland areas was categorized into three distances traveled from the wetland edge. Of the 65 species, we found that 77% use areas from the wetland edge to 100 ft. beyond it, 58.5% use areas from the edge to 200 ft. and 52% use areas from the edge to beyond 200 ft. from the wetland. There are 14 species (23%) known to depend on upland areas but distances are not documented. Included in the 65 species that lack adequate protection are 8 State-listed Species of Special Concern, 3 species listed as State Threatened and 1 species listed as both State and Federally Endangered. The information presented in this report demonstrates the urgent need for consideration to be given to the lack of protection provided to wetland wildlife habitat.

INTRODUCTION

Protected areas adjacent to water resources, often referred to as buffer zones, provide a number of functional capacities including the attenuation of pollutants or excess nutrients, aesthetic value, recreation areas and habitat essential to the life history requirements of wetland dependent species. Buffer zones protect wetlands and water bodies from adverse actions taking place in adjacent upland areas. Adverse actions (including agriculture, urban development and industrial use) in the buffer zones of wetlands and streams can often result in changes to the biological, chemical and physical properties of these aquatic resources. In turn, these changes can lead to a reduction in wetland and stream functional value (Castelle et al., 1994).

Castelle et al. (1994) defined buffers as "vegetated zones located between natural resources and adjacent areas subject to human alteration." The need for maintaining a buffer zone adjacent to wetlands or the edges of water bodies is well documented; the width, however, is contested. "The effectiveness of riparian forests to perform ecological functions including acting as dispersal corridors between forest fragments, enhancing the biodiversity of agricultural landscapes, and helping to improve water quality depends upon the width of the riparian forest (Keller et al., 1993)." Castelle et. al (1994) suggested that the size of the buffer should be determined depending upon the resource value, the intensity of adjacent land use, buffer characteristics (e.g. slope, soil type) and specific buffer functions.

Purpose and Need

The Non-Game Advisory Committee (NGAC) for the Massachusetts Division of Fisheries and Wildlife Natural Heritage and Endangered Species program has suggested that in some cases the Massachusetts wetland protection regulations fail to protect buffer zones essential to wetland dependent wildlife (personal communication, J.S. Larson, Massachusetts Fisheries and Wildlife Board). For some species, areas adjacent to wetlands are crucial to their survival. Semlitsch (1998) termed the upland area used by salamanders as well as other semi-aquatic species as a "life zone" containing critical habitat for the survival of these species. Many species that require habitat in upland areas adjacent to wetlands and water bodies may not be receiving adequate protection under existing regulations. Identification of these species and their habitat requirements will assist in evaluating this issue.

Scope

This report addresses the buffer zone issue in terms of wildlife habitat. It entails a synthesis of available information on buffer zones and buffer zone requirements for wetland dependent wildlife species in Massachusetts. For the purposes of this document "wildlife" refers to reptiles, amphibians, mammals and birds. The project includes only those species dependent on freshwater wetlands in Massachusetts with documented use

of upland adjacent to the wetland for activities including nesting, hibernation/aestivation, and feeding. Wetland dependent as defined in Whitlock et al. (1994) and Crowley et al. (1996) is as follows: species that may use non-wetland habitats, but occur in wetlands a preponderance of the year, or have critical life requirements met by wetlands that are not provided by non-wetlands (Adamus et al., 1987⌘▲).

The term "buffer zone" refers to the area of land adjacent to a wetland or water body. This document addresses the land adjacent to wetlands and water bodies as it pertains to wildlife habitat. The treatment and context of this area and its protection varies and must be clarified. A buffer zone is generally thought of as a buffer against human generated disturbance in areas adjacent to the wetland. In terms of the regulations the buffer zone extends horizontally 100 ft. from the wetland edge. The upland adjacent to the wetland is critical to the survival of wetland dependent wildlife, and its importance for wildlife extends well beyond 100 ft. This adjacent upland provides the habitat critical for activities including nesting, feeding, cover, and over-wintering. Without providing protection to the adjacent upland a wetland is unable to support the same biodiversity. Therefore the adjacent land is really a “life zone” not just a buffer protecting these species from adjacent human activities. When the buffer zone is referred to in scientific literature it is generally referring to upland adjacent to the wetland and not the limited regulated buffer zone. When we discuss literature in this paper, will we maintain the authors wording and use buffer zone. When referring to the buffer zone in terms of the regulations, we will refer to it as the "regulated buffer zone".

The term "riverfront area" refers to the land adjacent to any river as it is defined in 310 CMR 10.58. In terms of the regulations, a distinction must be made concerning the treatment of the buffer zone vs. the riverfront area. The regulated buffer zone is not a protected wetland resource area. It is a regulated area that is adjacent to the protected wetland that is provided indirect protection. Under current regulations this area is considered valuable in that it provides protection to the wetland. The inherent value of

⌘ - This symbol indicates a reference taken directly from Whitlock et al. (1994).
▲ - This symbol indicates a reference taken directly from Crowley et al. (1996).

this adjacent land itself for wetland dependent species is not considered. In contrast, 310 CMR 10.58, the Rivers Protection Act, incorporates the "life zone" concept by including the adjacent upland in the protected system.

The results of the synthesis are intended to assist in determining the adequacy of the current Massachusetts wetland regulations for protection of wetland wildlife habitat in Massachusetts.

The Statutory Environment

There are two Massachusetts State laws that provide protection to areas adjacent to wetlands. These are the Massachusetts Wetlands Protection Act and the Rivers Protection Act.

Massachusetts Wetlands Protection Act

The Massachusetts Wetlands Protection Act (MWPA), (Massachusetts General Laws (M.G.L.) Chapter 131 Section 40) first passed in 1972, is implemented by Chapter 310, Code of Massachusetts Regulations (CMR), Section 10. The purpose of the MWPA is to provide protection to wetland resources with respect to the following eight interests:

-Protection of public and private water supply
-Protection of ground water supply
-Flood control
-Storm Damage Prevention
-Prevention of Pollution
-Protection of Land Containing Shellfish
-Protection of Fisheries
-Protection of Wildlife Habitat

Wildlife habitat is defined in M.G.L. c. 131, section 40 to mean: “those areas subject to M.G.L. c. 131 section 40 which due to their plant community composition and structure, hydrologic regime or other characteristics, provide important food, shelter, migratory or overwintering areas for wildlife.”

The areas protected under the act are listed in 310 CMR 10.02 (1) and are limited to the following:

(a) Any bank, Any freshwater wetland, Any coastal wetland, Any beach, Any dune, Any flat, Any marsh, Or any swamp — bordering on — any ocean, any estuary, any creek, any stream, any pond, or any lake

(b) Land under any of the water bodies listed above

(c) Land subject to tidal action

(d) Land subject to coastal storm flowage

(e) Land subject to flooding

(f) Riverfront Area

Any activity (other than those exempted from this statute) that is proposed within one of these areas that will remove, fill, dredge or alter the resource area is subject to regulation under M.G.L. c. 131 Section 40. If a project includes such activities, those responsible are required to file a Notice of Intent (NOI) (310 CMR 10.02 (2) (a)" with the local conservation commission (CONCOM).

The MWPA also regulates activities within the buffer zone. The buffer zone is defined under the act as "that area of land extending 100 feet horizontally outward from the boundary of any area specified in 310 CMR 10.02(1)(a) [see (a) above]". It regulates only those activities within the buffer zone that result in the alteration of a protected wetland area. Under 310 CMR 10.02: (2) (b): Activities within 100 ft. of wetland areas specified in the act in 10.02: (1) (a) which, in the judgment of the issuing authority, will alter an area subject to protection are regulated. Responsible parties with projects

occurring within the buffer zone area are required to file a Request for Determination of Applicability with the CONCOM so that potential impacts of the project can be evaluated. If the activities are determined by the CONCOM to impact the wetland resource a NOI must be filed with the CONCOM.

The MWPA does not provide direct protection to the upland habitat that many wetland dependent species require for completion of their life cycle. Instead it provides indirect protection over some areas of the buffer zone by regulating activities that will alter the physical, biological or chemical characteristics of the wetland through impact to habitat features or overland flow into the wetland.

The Rivers Protection Act

The Rivers Protection Act (RPA) was an amendment to the MWPA and is also found in Massachusetts general laws (MGL) Chapter 131 Section 40. It was passed in 1996 and implemented in 1997 by Chapter 310, Code of Massachusetts Regulations, Section 10. The regulation states that riverfront areas protect the same eight interests as the MWPA, and so must be preserved.

The riverfront area is defined as "the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 200 feet away (310 CMR 10.58 (2)(a))." There are a few exceptions to the 200 ft. rule. A 25 foot riverfront area is required for certain urban areas, and a 100 ft. riverfront area is required for new agriculture and aquaculture. The definition of a river under this act is: "any natural flowing body of water that empties to any ocean, lake, pond, or other river and which flows throughout the year. Perennial streams are rivers; intermittent streams are not (310 CMR 10.58 (2)(a))."

When a proposed activity involves work within the riverfront area, the area is presumed to be significant to the protection of the eight interests identified in the MWPA (310 CMR 10.58 (3)). The presumption may be overcome by proving that the riverfront does not protect these interests. If the presumption is not overcome, "the applicant shall prove by a preponderance of evidence that there is no practicable and substantially equivalent

economic (310 CMR 10.58 (4))" alternative to the project. The work, including any proposed mitigation, must have no significant adverse impact on the riverfront area and protect the eight interests identified in the act.

METHODS

This report is formatted to document specific information on wildlife use of the upland adjacent to the wetland, and provides quick access to this pertinent information. Two primary sources were used for this document. They are: WEThings; *Wetland Habitat Indicators for NonGame Species, Wetland-Dependent Amphibians, Reptiles and Mammals of New England* (Whitlock et al., 1994) and WETHINGS, *Habitat Assessment Procedures for Wetland Dependant Birds in New England* (Crowley et al 1996). These sources were used directly due to their comprehensive nature. Both sources compiled all available information on habitat requirements for New England wetland dependent wildlife. They then developed models to predict the presence of habitat for wetland dependent wildlife *New England Wildlife - Habitat, Natural History and Distribution* (DeGraaf and Yamasaki, 2001) was also used to supplement this information.

Species Included

Species lists of wetland dependent wildlife were developed using the original species lists from Whitlock et al. (1994) and Crowley et al. (1996) as a starting point. The development of the final species list for this project can be followed in Appendix A.

Only those species that had documented evidence of use of the upland areas adjacent to the wetland were included. Some species initially considered were dropped from the list for the following reasons: dependency only on the wetland; lack of sufficient information to document use of both the wetland and upland; species distribution did not include Massachusetts; species occurred in Massachusetts during migration or wintering only and were not directly tied to upland areas in Massachusetts; the species occurrence in the state

is accidental in nature; or species used only saltwater habitats. The final species list can be found in Appendix B.

Tables

Tables were developed to display the wetland types and specific upland habitat requirements of each species of Massachusetts wetland dependent wildlife, and to display the distance that each travels into the upland from the wetland edge.

The first set of tables, Wetland Habitat Predictors for the 100 ft. Buffer Zone (Appendices C-F) shows the use of upland areas by wetland dependant reptiles, amphibians, mammals and birds, their basic habitat requirements and the specific features used in the upland.

The tables use the Cowardin classification of wetland systems down to class (Cowardin et al., 1979), shown in the first three columns. The next three columns show selected habitat features (taken from Whitlock et al., 1994 and Crowley et al., 1996) to illustrate the general occurrence of species but do not include all habitat features necessary to predict the presence of a species within the wetland type. The original predictor models from Whitlock et al. (1994) and Crowley et al (1996) should be referred to for this purpose. The next two columns identify the most important feature of the tables, the upland requirements for these wetland dependent species. The final column reveals the species occurring in the indicated wetland type.

A footnote in the “Dependent Species” column following the species name denotes those species that use areas beyond the 100-ft. buffer zone, and in the case of birds, also if they are found in Massachusetts during the migration, breeding and/or wintering periods.

There are minor differences in the tables for birds versus the tables for reptiles, amphibians and mammals. For birds “Wetland Size” replaced the “Landform” column. Many bird species are dependent upon a particular minimum wetland size in order for the habitat to be appropriate for use. Also, because “Upland Substrate” rarely plays a part in

determining bird species use of the upland "Additional Specific Nesting Requirements" replaced this column. It includes important features and information such as the presence of eroded banks in the upland for nesting bank swallows. The most direct tie to the upland for birds is nesting. Therefore the habitat requirements included for the bird species are those used during the nesting season.

A second set of tables, "Distances traveled from the Wetland", was developed to indicate distance traveled from the wetland (Appendix G). These tables compile for each wildlife species (column 1), documented distances traveled in the upland (second column). The final two columns indicate whether the animal uses areas from the wetland edge to 200 ft. beyond the wetland and from the wetland edge to beyond 200 ft. This table results in species divided into four categories of distances required beyond the wetland edge: those requiring up to 100 ft. beyond the wetland edge, up to 200 ft., those requiring more than 200 ft. beyond the wetland edge, and those for which a distance is not known.

Documented distances traveled in the upland were taken directly from the literature review in Whitlock et al. (1994) and Crowley et al. (1996) and DeGraaf and Yamasaki (2001). In some cases primary literature was also used to supplement this information.

Often, distances reported in the literature are extreme distances or the furthest traveled. When categorizing these species if a study indicated an average distance of travel, we took this information into account. For most species, the average and maximum distances traveled beyond the wetland edge were well beyond the distances used for categorizing species (100 ft., 200 ft. and beyond 200 ft.). When the average was close to 200 ft. and the maximum was well beyond 200 ft. (e.g. Painted Turtle and Common Snapping Turtle), the species was placed into the farther category. In the case of several species a study indicated a distance of general use and a maximum distance that they rarely reached. These species were categorized using the general use distance (e.g. Muskrat). Those species that were documented as using the upland but without a specific reference made to distance or had conflicting study results were included in an unknown category.

Comparison with Massachusetts Regulations

A comparison was made between wildlife habitat requirements and the protection of these essential elements by the Massachusetts wetland regulations. Using results developed in the tables, upland use was examined at distances from the wetland edge of 100 ft., 200 ft, and beyond 200 ft. For some species documentation of actual distances traveled into the upland were not available, but use of the upland is known. These species were included in an unknown category. Species use and dependency on these areas were compared and contrasted with the protection provided to the adjacent upland under the MWPA and the RPA.

RESULTS

A total of 65 freshwater wetland dependent wildlife species in Massachusetts are also dependent on the adjacent upland (for species list see Appendix B). This represents 76% of the 86 species of freshwater wetland dependent wildlife in Massachusetts. Table 1 (see below) illustrates the total numbers and distribution of species using upland areas from the wetland edge to 100 ft., to 200 ft. and beyond 200 ft. Species using the upland are distributed in a cumulative manner across the table.

Table 1. Wetland Dependent Species Use Beyond the Wetland Edge

	Edge to 100 ft.	Edge to 200 ft.	Edge to Beyond 200 ft.	Unknown	Totals
Reptiles	8	6	6	1	9
Amphibians	15	12	11	4	19
Mammals	10	8	8	4	14
Birds	17	12	9	6	23
Totals	50	38	34	15	65

Table 1 shows that 77% of these species use areas from wetland edge to 100 ft., 58.5% use areas from the edge to 200 ft., 52% use areas beyond 200 ft. and 23% are known to use the upland but distances are not documented. Table 2 below shows the total number of freshwater wetland dependent species in Massachusetts and distributes the total between those species requiring upland and those that are completely wetland dependent.

Table 2. Numbers of MA Freshwater Wetland Dependent (WD) Species with Upland Requirements

	Species with Upland Requirements	Species Without Upland Requirements	Total MA Freshwater WD Species*	% MA Freshwater WD with Upland Requirements
Reptiles	9	1	10	90%
Amphibians	19	1	20	95%
Mammals	14	0	14	100%
Birds	23	19	42	55%
Totals	65	21	86	76%

* See Appendix A for development of these numbers.

The results for Reptiles, Amphibians and Mammals show the most remarkable percentages at 90 %, 95 % and 100 % respectively. Specific information for reptiles, amphibians, mammals and birds is presented below. References made to distances can be found in Appendix G "Distances Traveled from Wetland".

Reptiles

Ninety-percent of wetland dependent reptile species in Massachusetts also depend on the adjacent upland (see Appendix C). The 9 species include 2 State Species of Special Concern (Spotted Turtle and Wood Turtle), 1 species listed as State Threatened (Blanding's Turtle) and 1 species listed as both State and Federally Endangered (Plymouth Redbelly Turtle). Of the 9 species, 6 (67%) move beyond 200 ft. from the

wetland edge (see Appendix G). The three listed species are included in those that move beyond the 200 ft.

Wetland Edge to 100 ft.

Both the Northern Water snake and Ribbon snake use upland areas for basking and feeding. The Northern Water snake is typically found within 32.8 ft. (10 m) of the water's edge (King, 1986⌘). The Common Musk turtle nests relatively close to the wetland in loamy soil 9.8-36 ft. (3-11 m) from water (Ernst, 1986⌘).

Wetland Edge to Beyond 200 ft.

The remaining 6 reptile species; Wood Turtle, Painted Turtle, Spotted Turtle, Blanding's Turtle, the Plymouth Redbelly Turtle and the Common Snapping Turtle use areas beyond the 200 ft. from the wetland edge. All of the turtles included in the study nest within the upland at various distances, most average less than 656 ft. (200 m) from the wetland. This group often travels extensive distances into the upland, up to 0.8 miles (1.3 km), and in the case of the Common Snapping Turtle up to nearly 10 miles (20 km).

Unknown

There are not documented distances of movement beyond the wetland for the Ribbon Snake. However, it is noted to use well-drained grassy areas adjacent to marshes for basking (Carpenter, 1953⌘). The average activity range for the Ribbon Snake is 2 acres and the average distance traveled between captures was 318.2 ft (97.9 m).

Exclusions

A total of 5 species originally considered in Whitlock et al. (1994) were dropped. The Northern Diamondback Terrapin was dropped because it does not use freshwater wetlands. The Eastern Spiny Softshell and Map Turtle are not found in Massachusetts. The Eastern Hognose Snake was dropped due to a secondary dependency on the wetland. Finally, the Bog Turtle, listed as State Threatened, was dropped due to lack of upland use. It is often found in shallow waters and its home range rarely extends beyond the transitional zone of the wetland (Chase et al., 1989⌘).

Amphibians

Ninety-five percent of Massachusetts's wetland dependent amphibians also depend upon upland areas (see Appendix D). Four of the 19 species are State Species of Concern (Northern Spring Salamander, Jefferson Salamander, Four-toed Salamander and Blue-spotted Salamander) and 2 are State listed as Threatened (Marbled Salamander and Spadefoot Toad). Of the 19 species included, 3 remain within 100 ft. of the wetland, 1 within 200 ft. and 4 are included in the unknown category. The majority, 58%, move beyond 200 ft. including both species listed as state threatened (see Appendix F).

Wetland Edge to 100 ft.

The 3 species that generally remain close to the wetland edge are Dusky Salamander, Bullfrog, and Green Frog. The Dusky Salamander is known to remain within about 20 ft. (6.1 m) of the water (Organ (1961⌘), Krzysik (1979⌘) and Jones (1986⌘). Bullfrogs are generally highly aquatic and do not venture far from their inhabited water body. Currie and Bellis (1969⌘) found Bullfrogs to have a mean daily activity radius of 2.6 m (8.5 ft) with a range of 0.61-11.3 m (2 -37.1 ft.). Adult Bullfrogs are known to migrate to other ponds, but the maximum distances of travel are unknown (Graves and Anderson, 1987⌘). Juvenile Bullfrogs will also disperse long distances overland (pers. com. Scott Jackson, University of Massachusetts). The Green Frog seldom moves more than 32.8 ft. (10 m) from the water's edge except for breeding (Martof, 1953a⌘), reportedly moving up to 984.3 ft. (300 m) to and from a breeding site (Martof, 1953a⌘).

Wetland Edge to 200 ft.

The Northern Leopard frog hibernates and breeds in water. During summer months they will use upland areas. In a study by Whitaker (1961⌘), 111 of 112 individuals were found within 54 m (177 ft) of water. Juveniles will disperse over 800 m (Dole, 1971⌘).

Wetland Edge to Beyond 200 ft.

A total of 11 amphibian species move beyond 200 ft (see Appendix F). These are: Marbled Salamander, Jefferson Salamander, Spotted Salamander, Blue-spotted Salamander, Two-lined Salamander, Red Spotted Newt, Spring Peeper, Wood Frog, Fowler’s Toad, Spadefoot Toad and American Toad. Many amphibians are terrestrial hibernators and use upland areas during winter months in addition to general use at other

times of the years. They depend on wetlands in the spring and summer for breeding purposes. Spring Peepers over winter in moist woodlands (Wright and Wright, 1949⌘) at distances of up to 984.3 ft. (300 m) from the water (Davis, 1992⌘). Marbled Salamander travel a mean distance of 636.5 ft. (194 m) (range 0-1476.4 ft. or 0-450 m) from the pond into the upland for non-breeding periods (Williams, 1973⌘). Wacasey (1961⌘) found Jefferson Salamanders up to 498.7 ft. (152 m) from their breeding pond. Spotted Salamanders have been found at distances ranging from 59.1 to 2700.1 ft. (18 m to 823 m) from their breeding pond (Gordon, 1968⌘). A study by Douglas and Monroe (1981⌘) showed a range of distances from 19.7 to 721.8 ft. (6 to 220 m) with a mean of 492.1 ft. (150 m). Blue-spotted Salamanders also use upland areas in the winter for hibernation. The mean distance traveled from the breeding pond was observed to be 656 ft. (Windmiller, 1996).

Other amphibian species use upland areas for feeding, seasonal movements to breeding areas or juvenile dispersal. Wood Frogs are terrestrial in the summer months and generally found up to 328.1 ft. (100 m) from water (mean 164 ft. or 50 m) (Roberts and Lewin, 1979⌘). Their average dispersal distance from the natal breeding pond was 554.5 +/-1151.6 ft. (169 +/- 351 m) to another breeding pond (Berven and Grudzien, 1990⌘). The Spadefoot toad is terrestrial and uses wetlands for breeding. These toads do not disperse far from breeding ponds. Dispersal distances ranged from 123 ft. to 250 ft. (37.5 m to 76.2 m), but Spadefoots will travel as far 1319 ft. (402 m) to reach breeding ponds (Pearson 1955⌘).

Unknown

Four species are included in the unknown category. Four-toed Salamanders build nests next to and just above water usually below or within sphagnum moss mats (Bishop, 1941 ⌘). They are known to use shaded or open wet woodlands (DeGraaf and Yamasaki, 2001). In winter, the Northern Spring Salamander is found in wet soil near water (DeGraaf and Yamasaki, 2001) and remains relatively close to water in forested areas (Whitlock et al., 1994). They do use upland areas for cover although distances are not documented. They require surface or spring waters that are clear and unpolluted (Whitlock et al., 1994). In the summer Pickerel Frogs are often found in wet pastures,

fields, rocky ravines, or woodlands, often at a distance from water (DeGraaf and Yamasaki, 2001). The Grey Treefrog is generally found in moist areas during the summer and is known to use bushes or small trees adjacent to ponds for breeding within 9.8 ft. (3 m) of the water's edge (Ptacek, 1992⌘). One pair was found amplexed 164 ft. (50 m) from a marsh within a forested area (Collins and Wilbur, 1979⌘). This Grey Treefrog is also often found at great distances from wetland (pers. com. Scott Jackson, University of Massachusetts).

Exclusions

Three amphibian species were dropped from those included in WEThings (Whitlock et al., 1994). The Western Chorus Frog and Mink Frog were dropped because of distribution outside of Massachusetts. The Mudpuppy is entirely aquatic and was dropped.

Mammals

A total of 14 wetland dependent mammal species use upland areas adjacent to the wetland (see Appendix E), 100% of wetland dependent species in Massachusetts. Two use areas within 100 ft. of the wetland edge, 8 use areas from the wetland edge to beyond 200 ft. of the wetland (see Appendix G) and 4 are included in the unknown category. Two State Species of Concern, the Water Shrew and Eastern Small-footed Myotis, are included in the 8 species that travel beyond 200 ft.

Wetland Edge to 100 ft.

Two species remain within 100 ft. of the wetland edge. Muskrat stay close to the water and their primary lodge. They stay generally within 50 ft., but will rarely go up to 500 ft. from their lodge (MacArthur, 1978 ✥). They feed on aquatic vegetation and rely on dense herbaceous vegetation within 6.2 ft. (10 m) of water's edge (Allen and Hoffman, 1984⌘). River Otter use hollow logs, jumbles of loose rock, abandoned or unused structures for dens along the watercourse (Toweill and Tabor, 1982⌘). Their typical

✥ - This symbol indicates a reference taken directly from DeGraaf and Yamasaki (2001).

home range is 0.7 to 22 square miles (1.8-57 km^2)(Melquist and Dronkert, 1987✥). Generally travel is along streamcourses, but overland travel occurs especially for juveniles establishing a residence.

Wetland Edge to Beyond 200 ft.

Some species feed in the wetland and use the upland for nesting. The Water Shrew remains close to the water for feeding on aquatic insects. Layne and Shoop (1971⌘) found a population site 80.1 ft. (24.4 m) from the edge of a temporary pond. Wrigley et al. (1979⌘) found all population sites within 1000 ft. (several hundred meters) of a watercourse. Hickman (1993⌘) found Star-nosed mole nests at 23 ft and 328.1 ft. (7 m and 100 m) from the stream edge. Bats are highly mobile and use wetlands for feeding and adjacent upland areas for roosting. "Still water is an important resource within the forest that attracts bats from a wide area, providing drinking and feeding opportunities (Krusic et al., 1996)." They are known to fly as far as 12.4 miles (20 km) from roosting to foraging sites (Fenton, 1989)

Other species forage in the upland and live within the wetland. Beaver forage up to several hundred feet from the pond in adjacent upland areas (Howard and Larson, 1953⌘). Allen (1983⌘) found Beaver used primary feeding habitat within 328.1 ft. (100 m) of open water.

Unknown

Four species are known to use both wetland and upland, but do not have specific distances reported. The Smoky Shrew is found typically near streams with moss-covered banks (Burt and Grossensheider, 1976 ✥). The Masked Shrew uses brushy areas near streams (Godin, 1977⌘). Pagels and Tate (1976⌘) reported trappings within 65.6 ft. (20 m) of streams. However, a study by Brooks and Doyle (2001) found no significant differences in abundance between pond-side and upland habitat for the Masked Shrew, therefore we included it in the unknown category. The Meadow Jumping Mouse depends upon thick stands of herbs and grasses that are supported by moist soils often found adjacent to wetlands (Godin, 1977⌘). Mink will use upland areas for foraging (Allen, 1986⌘) and forested log-strewn and thicketed areas for den sites (Godin, 1977⌘). Average home range is 2-3 miles (3.2-4.8 km) in diameter for males (Mitchell, 1961✥).

Exclusions

A total of 11 mammals were dropped from those species included in Whitlock et al. (1994). Six were dropped due to their more generalized use of the wetland and upland without direct ties to both. These are Raccoon, Black Bear, White-tailed Deer, Moose, Southern Bog Lemming and Ermine. The Northern Bog Lemming and Pygmy Shrew were dropped because they are not found in Massachusetts. Northern Short-tailed shrew, Meadow Vole and Southern Red-backed Vole were dropped in accordance with the WEThings model that found a lack of documented evidence to categorize them as wetland dependent.

Birds

In total, 23 bird species were found to be wetland dependent and to require upland areas (see Appendix F). This represents 55% of freshwater wetland dependent bird species in Massachusetts. Five species were found to remain within the 100 ft. of the wetland edge. These species are often bank nesters, so it is assumed they would often nest within 100 ft. of the wetland. There are 3 species that remain within 200 ft. of the wetland and 9 that extend beyond 200 ft. from the wetland edge (see Appendix G). A total of 6 species are known to nest in the upland, but documented distances are not known so they are included in the unknown category

Wetland Edge to 100 ft.

There are five species that will nest in banks close to water and so are included here. The Northern Waterthrush uses the edges of swamps, ponds, streams and woodland pools. Some nest under upturned roots on shady rocky shorelines of northern lakes (Sprunt, 1979▲) and are also known to nest on sides of fern clumps and under cover of banks of wooded ponds or streams (DeGraaf and Yamasaki, 2001). Several other species nest in banks near the water. The Louisiana Waterthrush uses both banks and gullies (Sprunt, 1979▲), the Bank Swallow nests near lakes and rivers (Zeranski and Baptist, 1990▲) and the Northern Rough-winged Swallow also uses pipe openings and the underside of bridges (Zeranski and Baptist, 1990▲). Canada Warblers usually nest in the vicinity of a stream, pond, or other water body on or near the ground atop logs or stumps, amid fern stands, or in bank cavities (DeGraaf and Yamasaki, 2001).

Wetland Edge to 200 ft.

Three bird species are documented as nesting within 200 ft. of the wetland. The Canada Goose typically nests near the water, but is known to nest as far as 150 ft. (DeGraaf and Yamasaki, 2001). They generally prefer a slightly elevated site including beaver lodges and old stumps for their nest. DeGraaf and Yamasaki (2001) note that the Gadwall nests on dry ground on islands in lakes, in upland meadows or pastures, and on prairies. Miller and Collins (1954▲) found 85 % of nests 3-50 ft. from water. DeGraaf and Yamasaki (2001) reported Gadwalls nesting usually within 165 ft. of water. One study by Rendell & Robertson (1989▲) found Tree Swallow nests to be more successful in cavities further (average 157.5 vs. 85.3 ft. or 48 m vs. 26 m) from shore. Information about nest sites further than 157.5 ft. (48 m) were not noted.

Wetland Edge to Beyond 200 ft.

There are 9 species that use areas beyond 200 ft. Distances range from 300 ft. to beyond a mile by some birds. Mallards remain the closest to the water's edge. DeGraaf and Yamasaki (2001) reported that Mallards typically nest on ground in dry or slightly marshy areas within 300 ft. of water, but occasionally up to 1.2 miles. Another found them to be more closely tied to the water and nest 3-50 ft. away from it (Miller & Collins, 1954▲).

The Green-winged Teal also uses areas relatively close to the water. They nest in depressions on dry ground in dense grass, at the base of shrubs, or under a log up to 1312.3 ft. (400 m) or more from the water, but usually within 3.3-298.6 ft. (1-91 m) (DeGraaf and Yamasaki, 2001). Bald Eagles usually nest within 656.2 ft (200 m) of water, but may be further (Stalmaster, 1987▲). Another study found Bald Eagle nests in large hardwoods within 2296.6 ft. (700 m) of shoreline (Lanier and Foss, 1989▲).

A number of species may extend as far as a mile. Belted Kingfishers are generally bank nesters, burrowing deep into sandy clay fairly close to the water, but can go up to a mile from the water (DeGraaf and Yamasaki, 2001). In a study by Cornwell, (1963▲) 2 nests were found over water, 3 were 500 ft. from a lake, and 4 were 0.3-1.0 miles from water.

Wood Ducks prefer natural cavities less than 1640.4 ft. (500 m) from water and near an opening in forest canopy (Dugger & Fredrickson, 1992▲). They normally nest within ½ mile, and seldom go beyond 1 mile (Flood et al., 1977▲). The Northern Pintail is known to nest in upland grasslands (Andrle & Carroll, 1988▲). They will nest up to a mile from water (Bellrose, 1980❖). The average distance from the water for a Blue-winged Teal nest was found to be 839.9 ft. (256m) and the greatest distance for nesting was found to be 3280.8 (1000m) away (Sousa, 1985▲). They have been known to nest as far as a mile from the water's edge, and generally use dense grassy sites (DeGraaf and Yamasaki, 2001). The American Black Duck generally nest on dry ground in an elevated hollow, well camouflaged by vegetation. Upland nests may be a mile or more from water (Palmer, 1976 ❖). Osprey have been known to use suitable nest sites as far as 3.1 miles (5 km) from a waterbody. They also require a space buffer between human disturbance (Zarn, 1974▲).

Unknown

A large portion of bird species listed here either do not have any reference to a specific distance, or are documented as using areas "near" water or "adjacent" to it. A total of 6 species are included in the unknown category. The Spotted Sandpiper is known to nest in grassy vegetation near the water (Andrle & Carroll, 1988▲). It also prefers to feed along gravel and stone margins of ponds and lakes (Zeranski and Baptist, 1990▲), however a distance traveled into the upland is not known. Great Egrets are known to nest near water in tall trees or thickets (DeGraaf and Yamasaki, 2001). Hooded Mergansers nest in tree cavities or nest boxes and prefer those near water (Morse et al., 1969 ❖). The Herring Gull is known to nest adjacent to wetlands on grassy hummocks or tall clumps of vegetation, drift, rock terraces, rocky cliffs, and on rooftops (DeGraaf and Rappole, 1995 ❖). The Common Snipe's nest is concealed among grasses or other vegetation on dry ground near wetlands (DeGraaf and Yamasaki, 2001). Great Blue Heron colonies are usually near water although herons may use upland sites away from water for nesting (Short and Cooper, 1985▲). Herons are also sensitive to human disturbance and a buffer zone of 250 ft. on land around heronries is recommended (Vos et al., 1985▲).

Exclusions

WEThings Birds includes 96 species. Twenty-three of these were found to be dependent on both the wetland the upland. A total of 73 species were dropped.

Many species included in WEThings Birds were dropped due to being dependent only on the wetland. These are: Pied-billed Grebe, Common Loon, Red-throated Loon, Mute Swan, Glossy Ibis, American Bittern, Least Bittern, Snowy Egret, Green-backed Heron, Black-crowned Night Heron, Canvasback, Ring-necked Duck, Virginia Rail, Sora, Common Moorhen, American Coot, Red-winged Blackbird and Marsh Wren.

Some species were dropped because they are wintering or migratory species in Massachusetts and are do not use upland areas during that life stage. These species are: Red-necked Grebe, Horned Grebe, Glaucous Gull, Iceland Gull, Ring-billed Gull, Black Tern, Great Cormorant, Redhead, Greater Scaup, Lesser Scaup, , Common Goldeneye, Barrow's Goldeneye, Bufflehead, Oldsquaw, Common Eider, Black Scoter, White-winged Scoter, Surf Scoter, Yellow Rail, Short-billed Dowitcher, Long-billed Dowitcher, Pectoral Sandpiper, White-rumped Sandpiper, Dunlin, Semi-palmated Sandpiper, Sanderling, Greater Yellowlegs, Lesser Yellowlegs, Solitary Sandpiper, Black-bellied Plover, Semi-palmated Plover, Ruddy Turnstone, Palm Warbler and Wilson's Warbler.

Other species were dropped due to the accidental nature of their occurrence during breeding within the state or complete lack of distribution within Massachusetts. These are: Common Merganser, Red-breasted Merganser, American Wigeon, Northern Shoveler, Ruddy Duck, Yellow-crowned Night Heron, King Rail, Rusty Blackbird, Sharp-tailed Sparrow, Lincoln's Sparrow, and Sedge Wren.

The American Woodcock, Northern Harrier, Alder Flycatcher, Willow Flycatcher, Swamp Sparrow, and Common Yellowthroat were dropped due to lack of sufficient documentation to indicate dependency on both the upland and the wetland. Saltwater dependent species that were dropped are the Double-crested Cormorant, Common Tern and Great Black-backed Gull.

DISCUSSION

The current wetland regulations do not provide adequate protection to wetland wildlife habitat. The MWPA provides indirect protection to a regulated buffer zone extending horizontally 100 ft. beyond the wetland. Prevention of activities within the regulated buffer zone will only occur when those activities are identified as having a negative affect on the wetland. Generally the regulated buffer zone is protected if overland flow discharges excess soil particles or other undesirable by-products into the wetland. This provides only limited protection. A conclusion drawn by Findlay and Houlahan (1996) can be aptly applied to the Massachusetts wetland regulations. "Wetland policies, which either do not regulate adjacent land use or regulate only a narrow buffer zone around the wetland edge, are unlikely to adequately protect wetland biodiversity from certain types of human activities."

In contrast the RPA provides full and direct protection to the 200 ft. riverfront area adjacent to the river. This land is recognized as integral to maintaining an intact and healthy riparian ecosystem.

Seventy-six percent of 86 freshwater wetland dependent species in Massachusetts also require upland areas. Of these 65 species, 52% require areas that extend beyond 100 ft. from the wetland edge (see Appendix G). This includes 5 of the 8 State-listed species of Concern the 3 State-listed as Threatened species and the State- and Federally-listed Endangered Plymouth Redbelly Turtle.

The land adjacent to a wetland is an interface between aquatic and terrestrial communities. It provides those species dependent on both the aquatic and terrestrial communities, essential habitat elements indirectly and directly. The adjacent upland provides a buffer zone for the wetland. This land and vegetation present is helpful through the attenuation of excess nutrients and pollutants. It aids in the reduction of sedimentation to maintain the water quality and clarity important for many species. Inputs of leaf litter and other particulate matter from vegetation on adjacent lands

provides food for macro-invertebrates that in turn are food for those higher in the food chain. The adjacent upland directly provides essential habitat features to wetland wildlife such as vegetation structure and composition, upland substrate, snags and downed logs, woody debris, banks for nesting, and rocky ledges. These adjacent lands are used for a number of activities including movement (i.e. dispersal), feeding, basking, hibernation/aestivation, and nesting. We found some general differences between the use of the upland by reptiles, amphibians, birds and mammals.

Reptiles

Reptiles have the broadest range of uses for the upland. These include nesting, feeding, overland dispersal, movement to breeding ponds, basking, cover and aestivation. Many reptiles use areas adjacent to the wetland for basking or cover. The Northern Water snake uses open areas adjacent to the wetland for basking and shoreline vegetation and shallow water aquatic vegetation for protection from predators (Chase et al., 1995). All turtle species included in this document are upland nesters and generally require a specific substrate for that purpose (see Appendix C). Distances traveled from the wetland for nesting range from 9.8-36 ft. (3-11 m) for the musk turtle to several kilometers for the common snapping turtle (see Appendix G). The spotted turtle travels between 42.7 and 1351.7 ft. (13-412 m) into the upland for aestivation [average distance is 584 ft. (178 m)].

The preamble of the RPA states "riverfront areas provide food for species such as wood turtles which feed and nest in uplands, but use rivers as resting and overwintering areas (310 CMR 10.58 (1))." However, the 200 ft. that the act protects is not sufficient for protecting the wood turtle's upland habitat. Wood turtles were found to nest 328.1-656.2 ft. (100-200 m) from water (Carroll and Ehrenfeld, 1978⌘) within areas of well-drained sandy or sandy loam. Without this critical upland habitat, reproduction is not possible.

Amphibians

Most amphibians are terrestrial for much of their lives and rely on the wetland for breeding and larval development. They depend upon upland areas for over-wintering. The distances traveled to hibernacula can be as far as 2700.1 ft. (823 m) for the Spotted

salamander (Gordan, 1968). Salamanders from the Ambystomatid genus including Spotted, Blue-spotted, Jefferson, and Marbled salamanders are all upland hibernators (Semlitsch, 1998) and require specific upland vegetation (see Appendix D). Spring Peepers, Wood frogs and Fowler's toads, also use upland habitat for overwintering. Other uses of the upland by amphibians include movement for breeding or dispersal, feeding and cover. Dispersal among pools is important for amphibian populations. In a study by deMaynadier and Hunter (1998), they discuss the importance of understory and overstory components contributing to canopy closure for forest amphibians as well as an abundance of cover refugia such as deep, uncompacted forest litter. These habitat components are especially important to juvenile amphibians that have a high surface area to volume ratio and are more subject to desiccation. Habitat disturbances that affect microclimates, such as canopy removal, can severely limit the movement and migration of amphibians (deMaynadier and Hunter, 1999). Of the species included in their 1998 study, deMaynadier and Hunter found that Wood Frogs and Spotted Salamanders were among the species most sensitive to loss of interior forested habitat.

Mammals

Mammals use the upland for feeding, cover, nesting, and in some cases for dispersal to other habitats (see Appendix E). A number of wetland dependent mammals use areas in the upland for foraging. These include the Beaver, Mink, Muskrat and River Otter. Beaver use upland areas with deciduous hardwoods within 200 m of the wetland (Whitlock et al., 1994). While most of their activity is focused within the high water mark, Mink travel as far as 600 ft. from water to hunt (Chase et al., 1995). Water Shrews use crevices beneath boulders, tree roots or overhanging banks for cover (DeGraaf and Yamasaki, 2001). Species that use upland areas for nesting include the Star-nosed Mole and Masked Shrew and River Otter. River Otters also usually construct dens in hollow logs, jumbles of loose rock, or abandoned/unused structures in the upland (Whitlock et al., 1994).

In general, mammals are more mobile than amphibians and reptiles and many mammal species (not included in the project) regularly use wetlands and the areas adjacent to them

for feeding or as travel corridors. These include White-tailed Deer, Raccoon and Black Bear. Wetlands are especially important for Black Bears in the spring as they often provide the earliest available green growth (Chase et al., 1995)

Birds

Birds use upland areas primarily for nesting and feeding. The most common use of the upland by wetland dependent birds is nesting. Many birds are cavity nesters and require trees of the appropriate diameter with cavities. These include the Wood Duck, Hooded Merganser and Tree Swallow (see Appendix F). Others use banks adjacent to riparian areas including the Kingfisher and Bank Swallow. Many species are ground nesters and use upland vegetation for that purpose including the Gadwall, American Black Duck and Green-winged Teal. In these cases vegetation type and structure can be important.

In addition to the provision of specific habitat elements, the land adjacent to a wetland can also provide needed space between wildlife and adjacent human disturbance. Many species require areas undisturbed by human presence to be successful in breeding. Several bird species require distance from human activity. They include the Great Blue Heron, Bald Eagle and Osprey. A 656.2 ft. (200 m) buffer in which human activity is prohibited is recommended for Osprey nesting areas (Call, 1979▲).

Buffer Width

While the need to provide protection to the adjacent upland to preserve the wildlife habitat function of wetlands is unquestioned, agreement on a proper width is difficult. There are numerous factors to consider. Palone and Todd (1997) suggested criteria for determining a width: existing or potential value of the resource, site, watershed and buffer characteristics, intensity of adjacent land use, and specific water quality and/or habitat functions desired.

Spackman and Hughes (1995) concluded “an appropriate corridor width for species conservation depends upon the stream and taxon of concern.” In their study on mid-order streams in Vermont, they found that their data did not provide a single width as the

appropriate corridor dimension for birds, mammals, and plants. An all-encompassing width of protected adjacent land is difficult to discern.

There have been a wide variety of estimates made for appropriate widths for various species. Semlitsch (1998) developed a biologically delineated buffer zone that applies to most species of *Ambystomatid* salamanders in most wetlands. A buffer zone of 538.1 ft. (164m) is recommended for the protection of upland habitat for these species.

Croonquist and Brooks (1993) determined that for the protection of the full complement of bird communities along riparian areas a buffer of greater than 410.1 ft. (125 m) was needed to approach reference conditions of an Eastern Hemlock forest. They believe that standard widths for undisturbed riparian corridors can be determined for specific landscape types.

Burke and Gibbons (1995) recommended a 902.2 ft. (275 m) buffer to protect upland nesting and hibernation sites of freshwater turtle species around Carolina bays in west central South Carolina. They found that a buffer of 239.5 ft. (73 m) protects all except the distal 10% of nesting and hibernation sites.

Findlay and Houlahan (1996) demonstrated the importance of maintaining a wide wetland buffer zone for species richness. "The removal of 20% of the forest cover on lands within 3280.8 ft. (1000 m) of a wetland appears to have approximately the same impact on herptile and mammal species richness as the loss of 50% of the wetland proper (Findlay and Houlahan, 1996)." The same was true of a 2.7 ft./ac (2m/ha) increase in total paved road density for plants, birds and herptiles.

On the Landscape Scale

Larger landscape scale characteristics, adjacent land use and wetland connectivity, are essential factors to consider when preserving adjacent upland habitat. Many studies have suggested the importance of examining the landscape scale when looking to protect wetlands. It provides a chance to look at the wetland in terms of position in the

watershed and slope. A study on wetland connectivity for waterbirds by Haig et al. (1998) cites three studies that encourage looking at conservation problems at larger spatial scales. Naimen et al. (1993) recognized the importance of a landscape perspective for riparian corridors.

By examining wetland protection on the landscape scale, it is easy to recognize the importance of considering wetland connectivity in tandem with the protection of adjacent upland. Lehtinen et al. (1999) found that "wetland amphibian species richness in both fragmented agricultural and urban landscapes have a negative relationship with decreased land connectivity (e.g., site isolation, road density, land-use)." Thus protection of wetland complexes and upland landscape is important for amphibian habitat protection.

The connectivity of wetlands on the landscape is also important for waterbirds. Within season movements (for example: between breeding areas, use of foraging areas away from the nest site, brood rearing habitat away from the nest site, and movement in response to re-nesting after early nest failure) are important for waterbirds. "These movements among breeding areas can be critical to enhancing the survival of young birds and allowing individuals of all ages to assess nesting territory and feeding-area quality in current and future years (Haig et al., 1998)." Wetland birds often depend on a variety of wetland types making wetland complexes essential.

In looking at protection on the landscape scale, it is important to acknowledge the importance of small wetlands and their connectivity. Many recent studies affirm that current legislation is not adequate to maintain small wetlands and thus amphibian populations (Semlitsch and Bodie, 1998, Gibbs, 1993, Lehtinen et al., 1999). The implication of the regulated buffer zone alone will not protect the metapopulation dynamics of amphibian species. Loss of small wetlands reduces the numbers of dispersing amphibians and increases dispersal distances. Maintaining the biodiversity and local populations depends upon the recolonization of local populations that have gone extinct. Simply protecting individual sites may not allow for survival of the species.

The connectivity on the landscape is directly related to adjacent land use, which is often very disruptive to wetland communities. While some species tolerate disturbance related to land use, the Ribbon Snake will use undisturbed to highly disturbed areas (Klemens, 1993 ❖), many do not.

"Urban areas are unfriendly habitats for anurans because of conversion of natural habitats to roads, home sites, and industrial uses (Knutson et al., 1999)." Associated contamination of wetlands due to these uses also contributes to unsuitability for anurans. The study by Knutson et al. (1999) found negative association with urban land use across most anuran guilds. Their study looked at 6 species included in this paper.

Some species do not tolerate any disturbance. Northern Spring Salamanders are not found in urban, suburban or disturbed areas (Whitlock et al., 1994). However, some minor disturbance could be tolerated outside a buffer zone. Burke and Gibbons (1995) suggest that small scale, low-impact development beyond 239.5 ft. (73 m) would protect 90% of nesting turtles.

Some types of disturbance can eliminate important elements in the upland and therefore create unsuitable habitat. Maintaining relatively undisturbed habitat is an important consideration not only in areas of forestry harvests, but also those areas that are used for livestock grazing. A study by Taylor (1986) showed that the impacts of cattle grazing reduces the structure of riparian vegetation and in turn causes a decrease in the number of bird species associated with it.

The landscape view of wetland protection would be helpful in determining a proper buffer zone width. With so many species requiring different widths, the question remains what width is a good width? It is, as discussed before, difficult to establish a blanket width appropriate for all purposes. However, the importance of providing full protection to at least the 100 ft. beyond the wetland is evident due to the fact that 77% of MA freshwater wetland dependent wildlife are dependent on that area.

CONCLUSIONS and RECOMMENDATIONS

Current wetland regulations are inadequate for protecting wildlife dependent on upland areas adjacent to wetlands. There are 65 wetland dependent species in Massachusetts that are also dependent on the upland. The current Massachusetts State regulations do not provide all habitat elements required by these species for survival and reproduction. Without protecting both the wetland and essential portions of the upland we are not providing full protection to wetland wildlife habitat.

The direct and active protection of the 100 ft. regulated buffer zone would provide some protection to 77% of those species that require upland habitat in addition to those elements provided by the wetland. Protection of this area would also serve to provide protection of the integrity of the wetland itself in terms of water quality. There is an additional need to provide protection to areas beyond the 100 ft. because 52% of MA wetland dependent wildlife are dependent on areas beyond 200 ft.

Currently the 200 ft. riverfront area is provided direct and full protection for wildlife habitat. The riverfront area is considered important to maintaining the integrity of the river itself. This same argument can be made for the wetland buffer zone, although it is not currently offered full protection. Without protecting the adjacent upland to the wetland, the wetland community is drastically changed. The wetland becomes isolated and is unable to support the ecologically diverse community that is possible with protected upland areas.

Some towns within Massachusetts have taken steps to provide additional protection to wetlands through the establishment of local by-laws that protect the regulated buffer zone. A town can enforce by-laws that provide additional protection and are stricter than the state regulations. Section 3A of the North Andover town by-laws regulates all activities in the buffer zone requiring a Notice of Intent to be filed with the conservation commission for projects within the buffer zone. Some towns extend their protection further and completely protect the 100 ft. buffer from building. The wetland by-law for

the town of Blackstone requires a NOI for any work within the regulated buffer and a 100 ft. setback from a wetland edge for any building.

In many cases towns lack sufficient information to develop additional by-laws. Information on species use of the upland provides towns with the justification to change by-laws and increase the restrictions within buffer zones and the distances that are protected in addition to requirements by the state of Massachusetts.

There is a need for more information to assist in the creation of adequate upland protection. More studies that examine not only the maximum width of protected upland but also the percentages of nesting animals within specific distances would be valuable. This type of information could be used to optimize regulated buffer widths from both economic and conservation perspectives. There are also information gaps on the use of the upland and distances traveled by particular species. There are a total of 15 species included in the unknown category due to this lack of information.

If protection of wetland dependent wildlife habitat is an objective of the Massachusetts Wetland Protection Act, a re-examination and re-evaluation of the regulations are essential. A focused and adaptable element of wildlife habitat protection from a landscape perspective, including connectivity and adjacent land use, is necessary.

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⌘ - This symbol indicates a reference taken directly from Whitlock et al. (1994).

▲ - This symbol indicates a reference taken directly from Crowley et al. (1996).

❖ - This symbol indicates a reference taken directly from DeGraaf and Yamasaki (2001).

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APPENDIX A

Species List Development

- Reptiles, Amphibians, Mammals and Birds -

SPECIES LIST DEVELOPMENT - REPTILES

Total Species in WEThings (14)	No Distribution within Massachusetts (2)	MA Wetland Dependent Not Freshwater (1)	MA Freshwater Wetland Dependent w/o Upland Habitat Needs (1)	Not Considered Wetland Dependent for the purposes of this paper (1)	MA Freshwater Wetland Dependent w/ Upland Habitat Needs (9)
Eastern Spiny Softshell	X				
Map Turtle	X				
Diamondback Terrapin		X			
Bog Turtle			X		
Eastern Hognose Snake				X	
Spotted Turtle					X
Common Snapping Turtle					X
Common Musk Turtle					X
Wood Turtle					X
Blanding's Turtle					X
Painted Turtle					X
Plymouth Redbelly Turtle					X
Ribbon Snake					X
Northern Water Snake					X

SPECIES LIST DEVELOPMENT - AMPHIBIANS

Total Species in WEThings (22)	No Distribution within Massachusetts (2)	MA Wetland Dependent Not Freshwater (0)	MA Freshwater Wetland Dependent w/o Upland Habitat Needs (1)	Not Considered Wetland Dependent for the purposes of this paper (0)	MA Freshwater Wetland Dependent w/ (19)
Western Chorus Frog	X				
Mink Frog	X				
Mudpuppy			X		
American Toad					X
Dusky Salamander					X
Two-lined Salamander					X
Fowler's Toad					X
Green Frog					X
Northern Spring Salamander					X
Bullfrog					X
Red-spotted Newt					X
Spotted Salamander					X
Four-toed Salamander					X
Marbled Salamander					X
Jefferson Salamander					X
Blue-spotted Salamander					X
Grey Treefrog					X
Spring Peeper					X
Wood Frog					X
Spadefoot Toad					X
Northern Leopard Frog					X
Pickerel Frog					X

SPECIES LIST DEVELOPMENT - MAMMALS

Total Species in WEThings (25)	No Distribution within Massachusetts (2)	MA Wetland Dependent Not Freshwater (0)	MA Freshwater Wetland Dependent w/o (0)	Not Considered Wetland Dependent for the purposes of this paper (9)	MA Freshwater Wetland Dependent w/ (14)
Northern Bog Lemmming	X				
Pygmy Shrew	X				
White-tailed Deer				X	
Black Bear				X	
Raccoon				X	
Moose				X	
Southern Bog Lemming				X	
Ermine				X	
Northern Short-tailed Shrew				X	
Meadow Vole				X	
Southern Red-backed Vole				X	
River Otter					X
Muskrat					X
Beaver					X
Mink					X
Masked Shrew					X
Little Brown Myotis					X
Silver-haired Bat					X
Eastern Pipistrelle					X
Keen's Myotis					X
Small-footed Myotis					X
Meadow Jumping Mouse					X
Water Shrew					X
Star-nosed Mole					X
Smoky Shrew					X

SPECIES DEVELOPMENT - BIRDS

Total Species in WEThings (96)	Accidental or No Distribution within Massachusetts (11)	MA Wetland Dependent Not Freshwater (3)	Wintering or Migratory and not directly tied to Upland at that time. (34)	MA Freshwater Wetland Dependent w/o Upland Habitat Needs (19)	Not Considered Wetland Dependent for the purposes of this paper (6)	MA Freshwater Wetland Dependent w/ Upland Habitat Needs (23)
Common Merganser	X					
Red-breasted Merganser	X					
American Wigeon	X					
Northern Shoveler	X					
Ruddy Duck	X					
Yellow-crowned Night Heron	X					
King Rail	X					
Rusty Blackbird	X					
Sharp-tailed Sparrow	X					
Lincoln's Sparrow	X					
Sedge Wren	X					
Double-crested Cormorant		X				
Common Tern		X				
Great Black-backed Gull		X				
Red-necked Grebe			X			
Horned Grebe			X			
Glaucous Gull			X			
Iceland Gull			X			
Ring-billed Gull			X			
Black Tern			X			
Great Cormorant			X			
Redhead			X			
Greater Scaup			X			
Lesser Scaup			X			

SPECIES DEVELOPMENT - BIRDS

Total Species in WEThings (96)	Accidental or No Distribution within Massachusetts (11)	MA Wetland Dependent Not Freshwater (3)	Wintering or Migratory and not directly tied to Upland at that time. (34)	MA Freshwater Wetland Dependent w/o Upland Habitat Needs (19)	Not Considered Wetland Dependent for the purposes of this paper (6)	MA Freshwater Wetland Dependent w/ Upland Habitat Needs (23)
Common Goldeneye			X			
Barrow's Goldeneye			X			
Bufflehead			X			
Oldsquaw			X			
Common Eider			X			
Black Scoter			X			
White-winged Scoter			X			
Surf Scoter			X			
Yellow Rail			X			
Short-billed Dowitcher			X			
Long-billed Dowitcher			X			
Pectoral Sandpiper			X			
White-rumped Sandpiper			X			
Dunlin			X			
Semi-palmated Sandpiper			X			
Sanderling			X			
Greater Yellowlegs			X			
Lesser Yellowlegs			X			
Solitary Sandpiper			X			
Black-bellied Plover			X			
Semi-palmated Plover			X			
Ruddy Turnstone			X			
Palm Warbler			X			
Wilson's Warbler			X			
Pied-billed Grebe				X		

SPECIES DEVELOPMENT - BIRDS

Total Species in WEThings (96)	Accidental or No Distribution within Massachusetts (11)	MA Wetland Dependent Not Freshwater (3)	Wintering or Migratory and not directly tied to Upland at that time. (34)	MA Freshwater Wetland Dependent w/o Upland Habitat Needs (19)	Not Considered Wetland Dependent for the purposes of this paper (6)	MA Freshwater Wetland Dependent w/ Upland Habitat Needs (23)
Common Loon				X		
Red-throated Loon				X		
Mute Swan				X		
Glossy Ibis				X		
American Bittern				X		
Least Bittern				X		
Snowy Egret				X		
Green-backed Heron				X		
Black-crowned Night Heron				X		
Canvasback				X		
Ring-necked Duck				X		
Virgina Rail				X		
Sora				X		
Common Moorhen				X		
American Coot				X		
Red-throated Loon				X		
Red-winged Blackbird				X		
Marsh Wren				X		
American Woodcock					X	
Northern Harrier					X	
Alder Flycatcher					X	
Willow Flycatcher					X	
Swamp Sparrow					X	
Common Yellowthroat					X	
Herring Gull						X

SPECIES DEVELOPMENT - BIRDS

Total Species in WEThings (96)	Accidental or No Distribution within Massachusetts (11)	MA Wetland Dependent Not Freshwater (3)	Wintering or Migratory and not directly tied to Upland at that time. (34)	MA Freshwater Wetland Dependent w/o Upland Habitat Needs (19)	Not Considered Wetland Dependent for the purposes of this paper (6)	MA Freshwater Wetland Dependent w/ Upland Habitat Needs (23)
Hooded Merganser						X
Mallard						X
American Black Duck						X
Gadwall						X
Green -winged Teal						X
Blue-winged Teal						X
Northern Pintail						X
Wood Duck						X
Canada Goose						X
Great Blue Heron						X
Great Egret						X
Common Snipe						X
Spotted Sandpiper						X
Bald Eagle						X
Osprey						X
Belted Kingfisher						X
Tree Swallow						X
Bank Swallow						X
Northern Rough-winged Swallow						X
Northern Waterthrush						X
Louisiana Waterthrush						X
Canada Warbler						X

APPENDIX B

Wetland Buffer Zones Species List

WETLAND BUFFER ZONES SPECIES LIST

REPTILES - 9 species

Spotted Turtle	*Clemmys guttata*
Common Snapping Turtle	*Chelydra s. serpentina*
Common Musk Turtle	*Sternotherus odoratus*
Wood Turtle	*Clemmys insculpta*
Blanding's Turtle	*Emydoidea blandingii*
Painted Turtle	*Chrysemys picta*
Plymouth Redbelly Turtle	*Pseudemys rubriventris bangsi*
Ribbon Snake	*Thamnophis sauritus*
Northern Water Snake	*Nerodia s. sipedon*

AMPHIBIANS - 19 species

American Toad	*Bufo a. americanus*
Dusky Salamander	*Desmognatuhus fuscus*
Two-lined Salamander	*Eurycea bislineata*
Fowler's Toad	*Bufo fowleri*
Green Frog	*Rana clamitans melanota*
Northern Spring Salamander	*Gyrinophilus p. porphyriticus*
Bullfrog	*Rana catesbeiana*
Red-Spotted Newt	*Notophthalmus v. viridescens*
Spotted Salamander	*Ambystoma maculatum*
Four-Toed Salamander	*Hemidactylium scutatum*
Marbled Salamander	*Ambystoma opacum*
Jefferson Salamander	*Ambystoma jeffersonianum*
Blue-Spotted Salamander	*Ambystoma laterale*
Grey Treefrog	*Hyla versicolor*
Spring Peeper	*Pseudacris c. crucifer*
Wood Frog	*Rana sylvatica*
Spadefoot Toad	*Scaphiopus holbookii*
Northern Leopard Frog	*Rana pipiens*
Pickerel Frog	*Rana palustris*

WETLAND BUFFER ZONES SPECIES LIST

MAMMALS - 14 species

River Otter	*Lutra canadensis*
Muskrat	*Ondatra zibethicus*
Beaver	*Castor canadensis*
Mink	*Mustela vison*
Masked Shrew	*Sorex cinereus*
Little Brown Myotis	*Myotis lucifugus*
Silver-haired Bat	*Lasionycteris noctivagens*
Eastern Pipistrelle	*Pipistrellus subflavus*
Keen's Myotis	*Myotis keenii*
Small-footed Myotis	*Myotis leibii*
Meadow Jumping Mouse	*Zapus hudsonius*
Water Shrew	*Sorex palustris*
Star-Nosed Mole	*Condylura cristata*
Smoky Shrew	*Sorex fumeus*

BIRDS - 23 species

Herring Gull	*Larus argentatus*
Hooded Merganser	*Lophodytes cucullatus*
Mallard	*Anas platyrhynchos*
American Black Duck	*Anas rubripes*
Gadwall	*Anas strepera*
Green -winged Teal	*Anas discors*
Blue-winged Teal	*Anas crecca*
Northern Pintail	*Anas acuta*
Wood Duck	*Aix sponsa*
Canada Goose	*Branta canadensis*
Great Blue Heron	*Ardea herodias*
Great Egret	*Casmerodius albus*
Common Snipe	*Capella gallinago*
Spotted Sandpiper	*Actitis macularia*
Bald Eagle	*Haliaeetus leucocephalus*
Osprey	*Pandion haliaetus*
Belted Kingfisher	*Megaceryle alcyon*
Tree Swallow	*Iridoprocne bicolor*
Bank Swallow	*Riparia riparia*
Northern Rough-winged Swallow	*Stelgidopteryx ruficollis*
Northern Waterthrush	*Seiurus noveboracensis*
Louisiana Waterthrush	*Seiurus motacilla*
Canada Warbler	*Wilsonis canadensis*

APPENDIX C

Wetland Habitat Predictors for the 100 ft. Buffer Zone

- Reptiles -

Adapted from: Whitlock A.L., N.M. Jarman, and J.S. Larson. 1994. WEThings: wetland habitat indicators for nongame species, wetland dependent amphibians, reptiles and mammals of New England, Vol. II, Pub. No. 94-2 The Environmental Institute, University of Massachusetts, Amherst. 627 pages.*

** The first six columns, wetland system through wetland vegetation, are selected features to illustrate the general occurrence of the species. They do not include all features necessary to predict the presence of a species. To predict species presence, the complete models in Whitlock et al. (1994) should be used. The final columns, upland substrate and upland vegetation denote upland features on which the species in column nine is dependant.*

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Riverine	Tidal	Any Riverine Tidal class [1]	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
		Any Riverine Tidal class [1]	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
		Any Riverine Tidal class [1]	IF NOT permanently flooded THEN adjacent to or hydrologically connected with a permanently flooded system.	Stream gradient > 4%, bank height > 0.2 m, AND bank slope > 10 degrees.		Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
	Lower Perennial	Any Riverine Lower Pernnial class [3]	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
		Any Riverine Lower Pernnial class [3]	Adjacent to forest (Palustrine wetland or upland) at least 100 m in width				Fallen logs, rock rubble, boulders, or rocky ledges present	Mink
		Any Riverine Lower Pernnial class [3]	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
WETLAND SYSTEM	**WETLAND SUBSYSTEM**	**WETLAND CLASS**	**JUXTAPOSITION**	**LANDFORM**	**WETLAND VEGETATION**	**UPLAND VEGETATION IN 100 ft. BUFFER ZONE**	**UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE**	**DEPENDENT SPECIES**
Riverine	Lower Perennial	Any Riverine Lower Pernnial class [3]	IF NOT permanently flooded THEN adjacent to or hydrologically connected with a permanently flooded system.	Stream gradient > 4%, bank height > 0.2 m, AND bank slope > 10 degrees.		Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
		Any Riverine Lower Perennial class [3]			Emergent vegetation present.	High shrub density OR other cover in the form of brush piles, debris or logs		Masked Shrew
		Any Riverine Lower Perennial class [3]				Dense stands of grass or herbaceous vegetation.	Moist soils.	Meadow Jumping Mouse
	Upper Perennial	Any Riverine Upper Pernnial class [4]	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
		Any Riverine Upper Pernnial class [4]	Adjacent to forest (Palustrine wetland or upland) at least 100 m in width				Fallen logs, rock rubble, boulders, or rocky ledges present	Mink

		Any Riverine Upper Pernnial class [4]				Dense stands of grass or herbaceous vegetation.	Moist soils.	Meadow Jumping Mouse
	Intermittent	Streambed				Dense stands of grass or herbaceous vegetation.	Moist soils.	Meadow Jumping Mouse
WETLAND SYSTEM	**WETLAND SUBSYSTEM**	**WETLAND CLASS**	**JUXTAPOSITION**	**LANDFORM**	**WETLAND VEGETATION**	**UPLAND VEGETATION IN 100 ft. BUFFER ZONE**	**UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE**	**DEPENDENT SPECIES**
Riverine		Any riverine class within the tidal, upper perennial, lower perennial or intermittent sub-system.[1,3,4]	Adjacent to forest OR buildings AND where open water is present.				IF no buildings are adjacent THEN forested upland is present.	Little Brown Myotis, Silver-haired Bat, Eastern Pipistrelle, Keen's Myotis, and Small-footed Myotis.[2]
Lacustrine	Littoral	Any littoral class [5]	Adjacent to forest (Palustrine wetland or upland) at least 100 m in width				Fallen logs, rock rubble, boulders, or rocky ledges present	Mink
		Any littoral class [5]	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
		Any littoral class [5]			Emergent vegetation present.	High shrub density, OR other cover in the form of brush piles, debris or logs		Masked Shrew
		Any littoral class [5]				Dense stands of grass or herbaceous vegetation.	Moist soils.	Meadow Jumping Mouse
Lacustrine		Any lacustrine class within the littoral or limnetic sub-system.[5,6]	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
WETLAND SYSTEM	**WETLAND SUBSYSTEM**	**WETLAND CLASS**	**JUXTAPOSITION**	**LANDFORM**	**WETLAND VEGETATION**	**UPLAND VEGETATION IN 100 ft. BUFFER ZONE**	**UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE**	**DEPENDENT SPECIES**
Lacustrine		Any lacustrine class listed above	IF NOT permanently flooded THEN adjacent to or hydrologically connected with a permanently flooded system.			Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
		Any lacustrine class listed above	Adjacent to forest OR buildings AND where open water is present.				IF no buildings are adjacent THEN forested upland is present.	Little Brown Myotis, Silver-haired Bat, Eastern Pipistrelle, Keen's Myotis, and Small-footed Myotis.[2]
Palustrine	(The palustrine system has no subsystems)	Unconsolidated Bottom			Trees or shrubs present.		Moist mull humus present.[7]	Water Shrew [2]
		Unconsolidated Bottom	Within 100 m of surface water		Trees, shrubs or emergent vegetation present.	Grass, sedge, shrub, or forest vegetation present	Moist to wet sand or finer-grained soil	Star-Nosed Mole[2]

		Aquatic Bed	IF NOT permanently flooded THEN adjacent to or hydrologically connected with a permanently flooded system.		Robust emergents present.	Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
		Unconsolidated Shore	Within 100 m of surface water		Trees, shrubs or emergent vegetation present.	Grass, sedge, shrub, or forest vegetation present	Moist to wet sand or finer-grained soil	Star-Nosed Mole[2]
		Moss-Lichen Wetland			Trees or shrubs present.		Moist mull humus present.[7]	Water Shrew [2]
WETLAND SYSTEM	**WETLAND SUBSYSTEM**	**WETLAND CLASS**	**JUXTAPOSITION**	**LANDFORM**	**WETLAND VEGETATION**	**UPLAND VEGETATION IN 100 ft. BUFFER ZONE**	**UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE**	**DEPENDENT SPECIES**
Palustrine	(The palustrine system has no subsystems)	Moss-Lichen Wetland	Within 100 m of surface water		Trees, shrubs or emergent vegetation present.	Grass, sedge, shrub, or forest vegetation present	Moist to wet sand or finer-grained soil	Star-Nosed Mole[2]
		Moss-Lichen Wetland				Dense stands of grass or herbaceous vegetation.	Moist soils.	Meadow Jumping Mouse
		Moss-Lichen Wetland	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
		Moss-Lichen Wetland			Emergent vegetation present.	High shrub density, OR other cover in the form of brush piles, debris or logs		Masked Shrew
		Moss-Lichen Wetland	Within or adjacent to coniferous or deciduous forest.				Adjacent coniferous or deciduous forest.	Smoky Shrew
		Emergent Wetland			Trees or shrubs present.		Moist mull humus present.[7]	Water Shrew [2]
		Emergent Wetland	Within 100 m of surface water			Grass, sedge, shrub, or forest vegetation present	Moist to wet sand or finer-grained soil	Star-Nosed Mole[2]
		Emergent Wetland	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
		Emergent Wetland	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
		Emergent Wetland				High shrub density, OR other cover in the form of brush piles, debris or logs		Masked Shrew
WETLAND SYSTEM	**WETLAND SUBSYSTEM**	**WETLAND CLASS**	**JUXTAPOSITION**	**LANDFORM**	**WETLAND VEGETATION**	**UPLAND VEGETATION IN 100 ft. BUFFER ZONE**	**UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE**	**DEPENDENT SPECIES**
Palustrine	(The palustrine system has no subsystems)	Emergent Wetland	IF NOT permanently flooded THEN adjacent to or hydrologically connected with a permanently flooded system.			Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
		Emergent Wetland				Dense stands of grass or herbaceous vegetation.		Meadow Jumping Mouse

		Scrub-Shrub Wetland	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
		Scrub-Shrub Wetland				Trees or shrubs and organic debris present	Moist mull humus present.[7]	Water Shrew[2]
		Scrub-Shrub Wetland	Within 100 m of surface water			Grass, sedge, shrub, or forest vegetation present	Moist to wet sand or finer-grained soil	Star-Nosed Mole[2]
		Scrub-Shrub Wetland	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
		Scrub-Shrub Wetland	IF NOT permanently flooded THEN Adjacent to or hydrologically connected with a permanently flooded system.		Robust emergents present.	Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
		Scrub-Shrub Wetland				Dense stands of grass or herbaceous vegetation.		Meadow Jumping Mouse
		Scrub-Shrub Wetland			Emergent vegetation present.	High shrub density, OR other cover in the form of brush piles, debris or logs		Masked Shrew
WETLAND SYSTEM	**WETLAND SUBSYSTEM**	**WETLAND CLASS**	**JUXTAPOSITION**	**LANDFORM**	**WETLAND VEGETATION**	**UPLAND VEGETATION IN 100 ft. BUFFER ZONE**	**UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE**	**DEPENDENT SPECIES**
Palustrine	(The palustrine system has no subsystems)	Scrub-Shrub Wetland	Within or adjacent to coniferous or deciduous forest.				Adjacent coniferous or deciduous forest.	Smoky Shrew
		Forested Wetland	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
		Forested Wetland				Trees or shrubs and organic debris present	Moist mull humus present.[7]	Water Shrew[2]
		Forested Wetland	Within 100 m of surface water			Grass, sedge, shrub, or forest vegetation present	Moist to wet sand or finer-grained soil	Star-Nosed Mole[2]
		Forested Wetland	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
		Forested Wetland			Emergent vegetation present.	High shrub density, OR other cover in the form of brush piles, debris or logs		Masked Shrew
		Forested Wetland	IF NOT permanently flooded THEN Adjacent to or hydrologically connected with a permanently flooded system.		Robust emergents present.	Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
		Forested Wetland				Dense stands of grass or herbaceous vegetation.	Moist soils.	Meadow Jumping Mouse

		Forested Wetland	Within or adjacent to coniferous or deciduous forest.				Adjacent coniferous or deciduous forest.	Smoky Shrew
WETLAND SYSTEM	**WETLAND SUBSYSTEM**	**WETLAND CLASS**	**JUXTAPOSITION**	**LANDFORM**	**WETLAND VEGETATION**	**UPLAND VEGETATION IN 100 ft. BUFFER ZONE**	**UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE**	**DEPENDENT SPECIES**
Palustrine	(The palustrine system has no subsystems)	Any Palustrine class [8]	IF NOT a Palustrine forested wetland, THEN adjacent to forest (upland or palustrine) at least 100 m in width. AND contains or is located within 100 m of permanently flooded to seasonally flooded surface waters.	IF Palustrine forested AND NOT adjacent to upland forest > 100 m in width, THEN part of a major forested wetland system.			Fallen logs, rock rubble, boulders, or rocky ledges present	Mink
		Any Palustrine class [8]	Adjacent to forest OR buildings AND where open water is present.				IF no buildings are adjacent THEN forested upland is present.	Little Brown Myotis, Silver-haired Bat, Eastern Pipistrelle, Keen's Myotis, and Small-footed Myotis.[2]

1. Riverine Tidal classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Streambed, Rocky Shore, Unconsolidated Shore or Emergent Wetland
2. Species uses areas beyond the 100 ft. buffer zone.
3. Riverine Lower Perennial classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Rocky Shore or Unconsolidated Shore
4. Riverine Upper Perennial classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Rocky Shore and Unconsolidated Shore.
5. Lacustrine Littoral classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Rocky Shore, Unconsolidated Shore and Emergent Wetland.
6. Lacustrine Limnetic classes are: Rock Bottom, Unconsolidated Bottom, and Aquatic Bed.
7. Moist mull humus refers to the top portion of forest soil. Mull humus consists of decmposed organic and mineral matter well mixed together. Unincorporated matted, compacted, or non-decomposed organic matter does not qualify.
8. Palustrine classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Unconsolidated Shore, Moss Lichen, Emergent, Scrub-Shrub and Forested.

APPENDIX D

Wetland Habitat Predictors for the 100 ft. Buffer Zone

- Amphibians -

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - AMPHIBIANS

Adapted from: Whitlock A.L., N.M. Jarman, and J.S. Larson. 1994. WEThings: wetland habitat indicators for nongame species, wetland dependent amphibians, reptiles and mammals of New England, Vol. II, Pub. No. 94-2 The Environmental Institute, University of Massachusetts, Amherst. 627 pages.*

**The first six columns, wetland system through wetland vegetation, are selected features to illustrate the general occurrence of the species. They do not include all features necessary to predict the presence of a species. To predict species presence, the complete models in Whitlock et al. (1994) should be used. The final columns, upland substrate and upland vegetation denote upland features on which the species in column nine is dependant.*

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Riverine	Tidal	Any tidal class$_1$	Quiet backwaters present, OR located within 100 m of a Lacustrine or Palustrine system.			Patches of emergent vegetation (persistent or non-persistent) or submergent vegetation in the water AND within 2 m of the wetland edge OR overhanging shrubs, root entanglements or other plant debris in the water AND along the shores or wetland edge.		Green Frog$_2$
Riverine	Lower Perennial	Any lower perennial class$_3$	Bordered by forest at least 10 m in width.			Deciduous or mixed deciduous forest.		Dusky Salamander
		Any lower perennial class$_3$	Borders upland forest or Palustrine forested wetland.			Deciduous or mixed deciduous forest.		Two-lined Salamander$_2$
		Any lower perennial class$_3$	Areas of quiet, shallow waters (such as coves, inlets, or backwaters, or pools) present.	Located on the Atlantic coastal plain, on glacial sand deposits, or within a major river valley.	Open canopy AND emergent vegetation or floating algal mats present AND NOT dominated by *Sphagnum* spp.	Open canopy within 200 m.	Well-drained sands or sandy loam.	Fowler's Toad$_2$

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - AMPHIBIANS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Riverine	Lower Perennial	Any lower perennial class$_3$	Quiet backwaters present, OR located within 100 m of a Lacustrine or Palustrine system.			Patches of emergent vegetation (persistent or non-persistent) or submergent vegetation in the water AND within 2 m of the wetland edge OR overhanging shrubs, root entanglements or other plant debris in the water AND along the shores or wetland edge.		Green Frog$_2$
	Upper Perennial	Any upper perennial class$_4$	Bordered by forest at least 10 m in width			Deciduous or mixed deciduous forest.		Dusky Salamander
		Any upper perennial class$_4$	Borders upland forest or Palustrine forested wetland.			Deciduous or mixed deciduous forest.		Two-lined Salamander$_2$
		Any upper perennial class$_4$	Bordered by forest and NOT located in suburban, urban, or disturbed areas.	Located at least 150 m above sea level.	The system must be forested or adjacent to a forested (upland or Palustrine) system.	The system must be forested or adjacent to a forested (upland or Palustrine) system.		Northern Spring Salamander
		Any upper perennial class$_4$	Areas of quiet, shallow waters (such as coves, inlets, or backwaters, or pools) present.	Located on the Atlantic coastal plain, on glacial sand deposits, or within a major river valley.	Open canopy AND emergent vegetation or floating algal mats present AND NOT dominated by *Sphagnum* spp.	Open canopy within 200 m.	Well-drained sands or sandy loam.	Fowler's Toad$_2$
	Intermittent	Streambed	Bordered by forest at least 10 m in width			Deciduous or mixed deciduous forest.		Dusky Salamander
		Streambed	Bordered by forest and NOT located in suburban, urban, or disturbed areas.	Located at least 150 m above sea level.	The system must be forested or adjacent to a forested (upland or Palustrine) system.	The system must be forested or adjacent to a forested (upland or Palustrine) system.		Northern Spring Salamander

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - AMPHIBIANS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Riverine	Intermittent	Streambed	Areas of quiet, shallow waters (such as coves, inlets, or backwaters, or pools) present.	Located on the Atlantic coastal plain, on glacial sand deposits, or within a major river valley.	Open canopy AND emergent vegetation or floating algal mats present AND NOT dominated by *Sphagnum* spp.	Open canopy within 200 m.	Well-drained sands or sandy loam.	Fowler's Toad[2]
Riverine		Any riverine class within the tidal, upper perennial, lower perennial or intermittent sub-system.[1,3,4]	Contains areas of quiet, shallow waters, such as coves, inlets, or backwaters, or pools.		Open canopy present over the flooded portion of the wetland or the areas of quiet water.		Logs, boards, flat stones, tunnels, detritus, or other cover present.	American Toad[2]
		Any riverine class listed above	Areas of slow-moving or still water present, AND IF NOT permanently flooded THEN located within 400 m of a permanently flooded or intermittently exposed system.			Shrubs, emergent vegetation, or woody organic debris (stumps, logs, branches) along the banks or shoreline, OR submergent, emergent, or floating-leafed vegetation or shrubs within the flooded portion of the wetland.		Bullfrog
		Any riverine class listed above			Contains areas of dense herbaceous vegetation or sphagnum moss.	Contains areas of dense herbaceous vegetation or sphagnum moss.		Pickerel Frog

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - AMPHIBIANS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Lacustrine	Littoral	Any littoral class[5]			> 50% of aquatic vegetation (floating-leafed emergent, submergent, and/or emergent vegetation present within the flooded portion of the wetland.	Eft Habitat ONLY (not present in all populations): > 30% tree canopy closure, AND >50% deciduous tree species, AND > 2 cm leaf litter and detritus/plant debris on the forest floor, AND herbaceous canopy closure (< 1 m in height) between 20 and 50%.		Red-Spotted Newt[2]
		Any littoral class[5]	Contains areas of quiet, shallow waters, such as coves, inlets, or backwaters, or pools.		Open canopy present over the flooded portion of the wetland or the areas of quiet water.		Logs, boards, flat stones, tunnels, detritus, or other cover present.	American Toad[2]
		Any littoral class[5]	Areas of quiet, shallow waters (such as coves, inlets, or backwaters, or pools) present.	Located on the Atlantic coastal plain, on glacial sand deposits, or within a major river valley.	Open canopy AND emergent vegetation or floating algal mats present AND NOT dominated by *Sphagnum* spp.	Open canopy within 200 m.	Well-drained sands or sandy loam.	Fowler's Toad[2]

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - AMPHIBIANS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Lacustrine	Littoral	Any littoral class[5]	IF NOT forested, THEN located within 300 m of a forested area (Palustrine or upland) AND IF NOT at least seasonally flooded, THEN located within 300 m of a wetland that is at least seasonally flooded.			IF NOT forested, THEN located within 300 m of a forested area (Palustrine or upland).		Spring Peeper[2]
		Any littoral class[5]				Patches of emergent vegetation (persistent or non-persistent) or submergent vegetation in the water AND within 2 m of the wetland edge OR overhanging shrubs, root entanglements or other plant debris in the water AND along the shores or wetland edge.		Green Frog[2]
		Any littoral class[5]	Pools of standing water present AND IF NOT forested, THEN forest present within 300 m.		> 25% vegetative cover, OR >50% cover of substrate with leaf litter or organic debris within the flooded portion of the wetland.	Deciduous or mixed deciduous forest.		Spotted Salamander[2]

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - AMPHIBIANS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Lacustrine		Any lacustrine class within the littoral or limnetic sub-system.[5,6]	IF NOT permanently flooded THEN located within 400 m of a permanently flooded or intermittently exposed system.			Shrubs, emergent vegetation, or woody organic debris (stumps, logs, branches) along the banks or shoreline, OR submergent, emergent, or floating-leafed vegetation or shrubs within the flooded portion of the wetland.		Bullfrog
		Any lacustrine class within the littoral or limnetic sub-system.[5,6]			Contains areas of dense herbaceous vegetation or sphagnum moss.	Contains areas of dense herbaceous vegetation or sphagnum moss.		Pickerel Frog
Palustrine	(The palustrine system has no subsystems)	Unconsolidated Bottom	Forested upland within 200 m of the wetland.		Leaf litter, matted aquatic vegetation (e.g., *Sphagnum* spp., *Polygonum* spp.), logs, or rocks within seasonally exposed areas.	Deciduous or mixed deciduous forest.		Marbled Salamander[2]
		Aquatic Bed	Pools of standing water present, AND forested areas adjacent to the wetland.		Sphagnum or other moss > 5 cm in depth, dense growth of grass or sedge, or water soaked rotten wood present within 10 cm or overhanging the pool.	Deciduous or mixed deciduous forest.		Four-Toed Salamander

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - AMPHIBIANS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Unconsolidated Shore	Forested upland within 200 m of the wetland.		Leaf litter, matted aquatic vegetation (e.g., Sphagnum spp., Polygonum spp.), logs, or rocks within seasonally exposed areas.	Deciduous or mixed deciduous forest.		Marbled Salamander$_2$
		Moss-Lichen Wetland	Pools of standing water present, AND forested areas adjacent to the wetland.		Sphagnum or other moss > 5 cm in depth, dense growth of grass or sedge, or water soaked rotten wood present within 10 cm or overhanging the pool.	Deciduous or mixed deciduous forest.		Four-Toed Salamander
		Emergent Wetland	Pools of standing water present, AND forested areas adjacent to the wetland.		Sphagnum or other moss > 5 cm in depth, dense growth of grass or sedge, or water soaked rotten wood present within 10 cm or overhanging the pool.	Deciduous or mixed deciduous forest.		Four-Toed Salamander
		Scrub-Shrub Wetland	Forested upland within 200 m of the wetland.		Leaf litter, matted aquatic vegetation (e.g., Sphagnum spp., Polygonum spp.), logs, or rocks within seasonally exposed areas.	Deciduous or mixed deciduous forest.		Marbled Salamander$_2$

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - AMPHIBIANS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Scrub-Shrub Wetland	Pools of standing water present, AND forested areas adjacent to the wetland.		Sphagnum or other moss > 5 cm in depth, dense growth of grass or sedge, or water soaked rotten wood present within 10 cm or overhanging the pool.	Deciduous or mixed deciduous forest.		Four-Toed Salamander
		Forested Wetland	Forested upland within 200 m of the wetland.		Leaf litter, matted aquatic vegetation (e.g., *Sphagnum* spp., *Polygonum* spp.), logs, or rocks within seasonally exposed areas.	Deciduous or mixed deciduous forest.		Marbled Salamander$_2$
		Forested Wetland	Pools of standing water present, AND forested areas adjacent to the wetland.		Sphagnum or other moss > 5 cm in depth, dense growth of grass or sedge, or water soaked rotten wood present within 10 cm or overhanging the pool.	Deciduous or mixed deciduous forest.		Four-Toed Salamander
		Forested Wetland	Borders a Riverine system, or contains seepage areas or springs.			Deciduous or mixed deciduous forest.		Dusky Salamander
		Forested Wetland	Borders Riverine upper or lower perennial wetland or contains seepage areas or springs.			Deciduous or mixed deciduous forest.		Two-lined Salamander$_2$
		Forested Wetland	Borders a Riverine system, or contains seepage areas or springs and must NOT be located in suburban, urban or disturbed areas.	Located at least 150 m above sea level.	The system must be forested or adjacent to a forested (upland or Palustrine) system.	The system must be forested or adjacent to a forested (upland or Palustrine) system.		Northern Spring Salamander

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - AMPHIBIANS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Any Palustrine class[7]				Patches of emergent vegetation (persistent or non-persistent) or submergent vegetation in the water AND within 2 m of the wetland edge OR overhanging shrubs, root entanglements or other plant debris in the water AND along the shores or wetland edge.		Green Frog[2]
		Any Palustrine class[7]	Pools of standing water present, AND some portion of the wetland bordered by forest AND isolated from urbanization or disturbance.			Deciduous or mixed deciduous forest.		Jefferson Salamander[2]
		Any Palustrine class[7]	For Palustrine Forested or scrub/shrub wetlands, IF NOT at least seasonally flooded, THEN located within 200 m of a permanently flooded to seasonally flooded Palustrine wetland.			Leaf litter, fallen logs or branches or other organic debris present.		Blue-Spotted Salamander
		Any Palustrine class[7]	Pools of standing water present AND IF NOT forested, THEN forest present within 300 m.		> 25% vegetative cover, OR >50% cover of substrate with leaf litter or organic debris within the flooded portion of the wetland.	Deciduous or mixed deciduous forest.		Spotted Salamander[2]

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - AMPHIBIANS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Any Palustrine class[7]			> 50% of aquatic vegetation (floating-leafed emergent, submergent, and/or emergent vegetation present within the flooded portion of the wetland.	Eft Habitat ONLY (not present in all populations): > 30% tree canopy closure, AND >50% deciduous tree species, AND > 2 cm leaf litter and detritus/plant debris on the forest floor, AND herbaceous canopy closure (< 1 m in height) between 20 and 50%.		Red-Spotted Newt[2]
		Any Palustrine class[7]			Open canopy present over the flooded portion of the wetland or the areas of quiet water.		Logs, boards, flat stones, tunnels, detritus, or other cover present.	American Toad[2]
		Any Palustrine class[7]	Contains or adjacent to areas of standing water, AND IF NOT Palustrine forested, THEN adjacent to a forested system (upland or Palustrine).		Woody or emergent vegetation present within 10 m of the areas of standing water.	Woody or emergent vegetation present within 10 m of the areas of standing water.		Grey Treefrog
		Any Palustrine class[7]	IF NOT forested, THEN located within 300 m of a forested area (Palustrine or upland) AND IF NOT at least seasonally flooded, THEN located within 300 m of a wetland that is at least seasonally flooded.			IF NOT forested, THEN located within 300 m of a forested area (Palustrine or upland).		Spring Peeper[2]

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - AMPHIBIANS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Any Palustrine class[7]	Contains standing water OR located within 1 km of a Palustrine system containing standing water, AND IF NOT Palustrine forested, THEN located within 1 km of a forested area (upland or Palustrine), AND not highly disturbed by human activity.			IF NOT Palustrine forested, THEN located within 1 km of a forested area (upland or Palustrine), AND not highly disturbed by human activity.		Wood Frog[2]
		Any Palustrine class[7]	Contains or is immediately adjacent to surface waters, AND IF surface waters are seasonally flooded or semi-permanently flooded, THEN located within 0.5 km of permanently flooded wetland.	Located in a major river valley.	Open canopy, AND dominated by persistent emergent vegetation.			Northern Leopard Frog
		Any Palustrine class[7]			Contains areas of dense herbaceous vegetation or sphagnum moss.	Contains areas of dense herbaceous vegetation or sphagnum moss.		Pickerel Frog

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - AMPHIBIANS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Any Palustrine class[7]	IF NOT permanently flooded THEN located within 400 m of a permanently flooded or intermittently exposed system.			Shrubs, emergent vegetation, or woody organic debris (stumps, logs, branches) along the banks or shoreline, OR submergent, emergent, or floating-leafed vegetation or shrubs within the flooded portion of the wetland.		Bullfrog
		Any Palustrine class[7]		Located on the Atlantic coastal plain, on glacial sand deposits, or within a major river valley.	Open canopy AND emergent vegetation or floating algal mats present AND NOT dominated by *Sphagnum* spp.	Open canopy within 200 m.	Well-drained sands or sandy loam.	Fowler's Toad[2]
		Any Palustrine class[7]				Fields (cultivated or uncultivated) or open forest within 200 m, AND dense shrub cover or thick leaf litter absent.	Loose, well drained sands.	Spadefoot Toad[2]

1. Riverine Tidal classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Streambed, Rocky Shore, Unconsolidated Shore and Emergent Wetland
2. Species uses areas beyond the 100 ft. buffer zone.
3. Riverine Lower Perennial classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Rocky Shore and Unconsolidated Shore
4. Riverine Upper Perennial classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Rocky Shore and Unconsolidated Shore.
5. Lacustrine Littoral classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Rocky Shore, Unconsolidated Shore and Emergent Wetland.
6. Lacustrine Limnetic classes are: Rock Bottom, Unconsolidated Bottom, and Aquatic Bed.
7. Palustrine classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Unconsolidated Shore, Moss Lichen, Emergent, Scrub-Shrub and Forested.

APPENDIX E

Wetland Habitat Predictors for the 100 ft. Buffer Zone

- *Mammals* -

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - MAMMALS

Adapted from: Whitlock A.L., N.M. Jarman, and J.S. Larson. 1994. WEThings: wetland habitat indicators for nongame species, wetland dependent amphibians, reptiles and mammals of New England, Vol. II, Pub. No. 94-2 The Environmental Institute, University of Massachusetts, Amherst. 627 pages.*

** The first six columns, wetland system through wetland vegetation, are selected features to illustrate the general occurrence of the species. They do not include all features necessary to predict the presence of a species. To predict species presence, the complete models in Whitlock et al. (1994) should be used. The final columns, upland substrate and upland vegetation denote upland features on which the species in column nine is dependant.*

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Riverine	Tidal	Any Riverine Tidal class [1]	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
		Any Riverine Tidal class [1]	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
		Any Riverine Tidal class [1]	IF NOT permanently flooded THEN adjacent to or hydrologically connected with a permanently flooded system.	Stream gradient > 4%, bank height > 0.2 m, AND bank slope > 10 degrees.		Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
	Lower Perennial	Any Riverine Lower Pernnial class [3]	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
		Any Riverine Lower Pernnial class [3]	Adjacent to forest (Palustrine wetland or upland) at least 100 m in width				Fallen logs, rock rubble, boulders, or rocky ledges present	Mink
		Any Riverine Lower Pernnial class [3]	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - MAMMALS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Riverine	Lower Perennial	Any Riverine Lower Pernnial class [3]	IF NOT permanently flooded THEN adjacent to or hydrologically connected with a permanently flooded system.	Stream gradient > 4%, bank height > 0.2 m, AND bank slope > 10 degrees.		Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
		Any Riverine Lower Perennial class [3]			Emergent vegetation present.	High shrub density OR other cover in the form of brush piles, debris or logs		Masked Shrew
		Any Riverine Lower Perennial class [3]				Dense stands of grass or herbaceous vegetation.	Moist soils.	Meadow Jumping Mouse
	Upper Perennial	Any Riverine Upper Pernnial class [4]	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
		Any Riverine Upper Pernnial class [4]	Adjacent to forest (Palustrine wetland or upland) at least 100 m in width				Fallen logs, rock rubble, boulders, or rocky ledges present	Mink
		Any Riverine Upper Pernnial class [4]				Dense stands of grass or herbaceous vegetation.	Moist soils.	Meadow Jumping Mouse
	Intermittent	Streambed				Dense stands of grass or herbaceous vegetation.	Moist soils.	Meadow Jumping Mouse

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - MAMMALS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Riverine		Any riverine class within the tidal, upper perennial, lower perennial or intermittent sub-system.[1,3,4]	Adjacent to forest OR buildings AND where open water is present.				IF no buildings are adjacent THEN forested upland is present.	Little Brown Myotis, Silver-haired Bat, Eastern Pipistrelle, Keen's Myotis, and Small-footed Myotis.[2]
Lacustrine	Littoral	Any littoral class [5]	Adjacent to forest (Palustrine wetland or upland) at least 100 m in width				Fallen logs, rock rubble, boulders, or rocky ledges present	Mink
		Any littoral class [5]	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
		Any littoral class [5]			Emergent vegetation present.	High shrub density, OR other cover in the form of brush piles, debris or logs		Masked Shrew
		Any littoral class [5]				Dense stands of grass or herbaceous vegetation.	Moist soils.	Meadow Jumping Mouse
Lacustrine		Any lacustrine class within the littoral or limnetic sub-system.[5,6]	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - MAMMALS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Lacustrine		Any lacustrine class listed above	IF NOT permanently flooded THEN adjacent to or hydrologically connected with a permanently flooded system			Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
		Any lacustrine class listed above	Adjacent to forest OR buildings AND where open water is present.				IF no buildings are adjacent THEN forested upland is present.	Little Brown Myotis, Silver-haired Bat, Eastern Pipistrelle, Keen's Myotis, and Small-footed Myotis.[2]
Palustrine	(The palustrine system has no subsystems)	Unconsolidated Bottom			Trees or shrubs present.		Moist mull humus present.[7]	Water Shrew [2]
		Unconsolidated Bottom	Within 100 m of surface water		Trees, shrubs or emergent vegetation present.	Grass, sedge, shrub, or forest vegetation present	Moist to wet sand or finer-grained soil	Star-Nosed Mole[2]
		Aquatic Bed	IF NOT permanently flooded THEN adjacent to or hydrologically connected with a permanently flooded system		Robust emergents present.	Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
		Unconsolidated Shore	Within 100 m of surface water		Trees, shrubs or emergent vegetation present.	Grass, sedge, shrub, or forest vegetation present	Moist to wet sand or finer-grained soil	Star-Nosed Mole[2]
		Moss-Lichen Wetland			Trees or shrubs present.		Moist mull humus present.[7]	Water Shrew [2]

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - MAMMALS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Moss-Lichen Wetland	Within 100 m of surface water		Trees, shrubs or emergent vegetation present.	Grass, sedge, shrub, or forest vegetation present	Moist to wet sand or finer-grained soil	Star-Nosed Mole[2]
		Moss-Lichen Wetland				Dense stands of grass or herbaceous vegetation.	Moist soils.	Meadow Jumping Mouse
		Moss-Lichen Wetland	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
		Moss-Lichen Wetland			Emergent vegetation present.	High shrub density, OR other cover in the form of brush piles, debris or logs		Masked Shrew
		Moss-Lichen Wetland	Within or adjacent to coniferous or deciduous forest.				Adjacent coniferous or deciduous forest.	Smoky Shrew
		Emergent Wetland			Trees or shrubs present.		Moist mull humus present.[7]	Water Shrew [2]
		Emergent Wetland	Within 100 m of surface water			Grass, sedge, shrub, or forest vegetation present	Moist to wet sand or finer-grained soil	Star-Nosed Mole[2]
		Emergent Wetland	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
		Emergent Wetland	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
		Emergent Wetland				High shrub density, OR other cover in the form of brush piles, debris or logs		Masked Shrew

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - MAMMALS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Emergent Wetland	IF NOT permanently flooded THEN adjacent to or hydrologically connected with a permanently flooded system.			Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
		Emergent Wetland				Dense stands of grass or herbaceous vegetation.		Meadow Jumping Mouse
		Scrub-Shrub Wetland	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
		Scrub-Shrub Wetland				Trees or shrubs and organic debris present	Moist mull humus present.[7]	Water Shrew[2]
		Scrub-Shrub Wetland	Within 100 m of surface water			Grass, sedge, shrub, or forest vegetation present	Moist to wet sand or finer-grained soil	Star-Nosed Mole[2]
		Scrub-Shrub Wetland	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
		Scrub-Shrub Wetland	IF NOT permanently flooded THEN Adjacent to or hydrologically connected with a permanently flooded system.		Robust emergents present.	Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
		Scrub-Shrub Wetland				Dense stands of grass or herbaceous vegetation.		Meadow Jumping Mouse
		Scrub-Shrub Wetland			Emergent vegetation present.	High shrub density, OR other cover in the form of brush piles, debris or logs		Masked Shrew

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - MAMMALS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Scrub-Shrub Wetland	Within or adjacent to coniferous or deciduous forest.				Adjacent coniferous or deciduous forest.	Smoky Shrew
		Forested Wetland	Deciduous hardwoods within 200 m				Contains deciduous hardwoods within 200m.	Beaver [2]
		Forested Wetland				Trees or shrubs and organic debris present	Moist mull humus present.[7]	Water Shrew[2]
		Forested Wetland	Within 100 m of surface water			Grass, sedge, shrub, or forest vegetation present	Moist to wet sand or finer-grained soil	Star-Nosed Mole[2]
		Forested Wetland	Adjacent to deciduous or mixed deciduous forest				Hollow logs, jumbles of loose rock, or abandoned/unused structures present	River Otter
		Forested Wetland			Emergent vegetation present.	High shrub density, OR other cover in the form of brush piles, debris or logs		Masked Shrew
		Forested Wetland	IF NOT permanently flooded THEN Adjacent to or hydrologically connected with a permanently flooded system.		Robust emergents present.	Submergent vegetation present, OR terrestrial herbaceous vegetation within 10 m of the wetland.		Muskrat
		Forested Wetland				Dense stands of grass or herbaceous vegetation.	Moist soils.	Meadow Jumping Mouse
		Forested Wetland	Within or adjacent to coniferous or deciduous forest.				Adjacent coniferous or deciduous forest.	Smoky Shrew

WETLAND HABITAT PREDICTORS FOR THE 100 ft. BUFFER ZONE - MAMMALS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	JUXTAPOSITION	LANDFORM	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	UPLAND SUBSTRATE IN 100 ft. BUFFER ZONE	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Any Palustrine class [8]	IF NOT a Palustrine forested wetland, THEN adjacent to forest (upland or palustrine) at least 100 m in width. AND contains or is located within 100 m of permanently flooded to seasonally flooded surface waters.	IF Palustrine forested AND NOT adjacent to upland forest > 100 m in width, THEN part of a major forested wetland system.			Fallen logs, rock rubble, boulders, or rocky ledges present	Mink
		Any Palustrine class [8]	Adjacent to forest OR buildings AND where open water is present.				IF no buildings are adjacent THEN forested upland is present.	Little Brown Myotis, Silver-haired Bat, Eastern Pipistrelle, Keen's Myotis, and Small-footed Myotis.[2]

1. Riverine Tidal classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Streambed, Rocky Shore, Unconsolidated Shore or Emergent Wetland
2. Species uses areas beyond the 100 ft. buffer zone.
3. Riverine Lower Perennial classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Rocky Shore or Unconsolidated Shore
4. Riverine Upper Perennial classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Rocky Shore and Unconsolidated Shore.
5. Lacustrine Littoral classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Rocky Shore, Unconsolidated Shore and Emergent Wetland.
6. Lacustrine Limnetic classes are: Rock Bottom, Unconsolidated Bottom, and Aquatic Bed.
7. Moist mull humus refers to the top portion of forest soil. Mull humus consists of decmposed organic and mineral matter well mixed together. Unincorporated matted, compacted, or non-decomposed organic matter does not qualify.
8. Palustrine classes are: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Unconsolidated Shore, Moss Lichen, Emergent, Scrub-Shrub and Forested.

APPENDIX F

Wetland Habitat Predictors for the 100 ft. Buffer Zone

- *Birds* -

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

Adapted from: Crawley, S.C. Welsh, P. Cavanaugh, and C. Griffin.1996, WETHINGS, Habitat Assessment Procedures for Wetland Dependant Birds in New England. Dept. of Forestry and Wildlife Management, UMASS, Amherst, MA

**The first six columns, wetland system through wetland vegetation, are selected features to illustrate the general occurrence of the species. They do not include all features necessary to predict the presence of a species. To predict species presence, the complete models in Crowley et al. (1996) should be used. The final columns, upland upland vegetation and additional specific nesting requirements denote upland features on which the species in column nine is dependant.*

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Rock Bottom	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$
		Rock Bottom	Moderately to large river.			Presence of large trees along banks separated from human disturbance AND overdominant trees separated from human disturbance present <3 km from wetland.	Water clear or moderately clear.	Bald Eagle $_{B, M, W,1}$
		Rock Bottom	Moderately to large river.			Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey $_{B, M,1}$
					Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher $_{B, M, W,1}$
		Rock Bottom			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Rock Bottom			Presence of > 0.1 ha open water or aquatic bed.		Presence of exposed eroded banks.	Bank Swallow B, M
		Rock Bottom		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow B, M
		Unconsolidated Bottom	Large river.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull B, M, W
		Unconsolidated Bottom	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser B, M
		Unconsolidated Bottom	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard B, M, W,I
		Unconsolidated Bottom		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	Ph >5.0 AND water level relatively stable.	American Black Duck B, M, W,I
		Unconsolidated Bottom	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall B, M,I

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Unconsolidated Bottom	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,1}$
		Unconsolidated Bottom	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,1}$
		Unconsolidated Bottom	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,1}$
		Unconsolidated Bottom	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Unconsolidated Bottom			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Unconsolidated Bottom			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Unconsolidated Bottom	Moderately to large river.			Presence of large trees along banks separated from human disturbance AND overdominant trees separated from human disturbance present <3 km from wetland.	Water clear or moderately clear.	Bald Eagle $_{B, M, W,1}$
		Unconsolidated Bottom	Moderately to large river.			Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey $_{B, M,1}$
		Unconsolidated Bottom			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher $_{B, M, W,1}$
		Unconsolidated Bottom			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow $_{B, M,1}$
		Unconsolidated Bottom			Presence of > 0.1 ha open water or aquatic bed.		Presence of exposed eroded banks.	Bank Swallow $_{B, M}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Unconsolidated Bottom		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow $_{B, M}$
		Aquatic Bed	Large river.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull $_{B, M, W}$
		Aquatic Bed	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$
		Aquatic Bed	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,1}$
		Aquatic Bed		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck $_{B, M, W,1}$
		Aquatic Bed	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,1}$
		Aquatic Bed	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Aquatic Bed	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,1}$
		Aquatic Bed	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,1}$
		Aquatic Bed	> 1 ha.		Presence of > 00.1 ha of emergent vegetation AND > 00.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Aquatic Bed			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,1}$
		Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Aquatic Bed	Moderately to large river.			Presence of large trees along banks separated from human disturbance AND overdominant trees separated from human disturbance present <3 km from wetland.	Water clear or moderately clear.	Bald Eagle $_{B, M, W,1}$
		Aquatic Bed	Moderately to large river.			Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey $_{B, M,1}$
		Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher $_{B, M, W,1}$
		Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow $_{B, M,1}$
		Aquatic Bed			Presence of > 0.1 ha open water or aquatic bed.		Presence of exposed eroded banks.	Bank Swallow $_{B, M}$
		Aquatic Bed		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow $_{B, M}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Streambed	Large river.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull $_{B, M, W}$
		Streambed	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$
		Streambed	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,1}$
		Streambed		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck $_{B, M, W,1}$
		Streambed	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,1}$
		Streambed	>2 ha	Presence of aquatic bed 5-100 cm deep.	Presence of > 0.1 ha of emergent vegetation and presence of >0.1 ha aquatic bed vegetation.	Fine leafed emergent nesting cover present <30 m from wetland.	Fine leafed emergent nesting cover present <30 m from wetland.	Green-winged Teal $_{B, M,1}$
		Streambed	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Streambed	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,1}$
		Streambed	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Streambed			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,1}$
		Streambed			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Streambed				Nests near water in tall trees or thickets.		Great Egret $_{B, M}$
		Streambed			Presence of > 0.5 ha of persistent emergent vegetation flooded 5-50 cm deep.		Nest concealed among grasses or sometimes on tussock of grass or sedge on dry ground.	Common Snipe $_{B, M}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Streambed	> 1 ha.	Similar wetlands are nearby.	Presence of >1 ha dense fine-leafed vegetation AND presence of >0.1 ha open water or aquatic bed.		Nests along edges of wetland.	Spotted Sandpiper $_{B,M}$
		Rocky Shore	Large river.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull $_{B, M, W}$
		Rocky Shore		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck $_{B, M, W,1}$
		Rocky Shore	> 1 ha.	Similar wetlands are nearby.	Presence of >1 ha dense fine-leafed vegetation AND presence of >0.1 ha open water or aquatic bed.		Nests along edges of wetland.	Spotted Sandpiper $_{B,M}$
		Unconsolidated Shore	Large river.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull $_{B, M, W}$
		Unconsolidated Shore	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Unconsolidated Shore	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,1}$
		Unconsolidated Shore		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck $_{B, M, W,1}$
		Unconsolidated Shore	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,1}$
		Unconsolidated Shore	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,1}$
		Unconsolidated Shore	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,1}$
		Unconsolidated Shore	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Unconsolidated Shore	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,I}$
		Unconsolidated Shore			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,I}$
		Unconsolidated Shore			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Unconsolidated Shore				Nests near water in tall trees or thickets.		Great Egret $_{B, M}$
		Unconsolidated Shore			Presence of > 0.5 ha of persistent emergent vegetation flooded 5-50 cm deep.		Nest concealed among grasses or sometimes on tussock of grass or sedge on dry ground.	Common Snipe $_{B, M}$
		Unconsolidated Shore	> 1 ha.	Similar wetlands are nearby.	Presence of >1 ha dense fine-leafed vegetation AND presence of >0.1 ha open water or aquatic bed.		Nests along edges of wetland.	Spotted Sandpiper $_{B,M}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Unconsolidated Shore		Shrub layer is adjacent to open water or aquatic bed.		Presence of > 1 ha live shrub vegetation or forested with shrub understory.	Shrub layer is adjacent to open water or aquatic bed.	Northern Waterthrush $_{B, M}$
		Emergent	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$
		Emergent	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,1}$
		Emergent		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck $_{B, M, W,1}$
		Emergent	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,1}$
		Emergent	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,1}$
		Emergent	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Emergent	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,1}$
		Emergent	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Emergent			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,1}$
		Emergent			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Emergent				Nests near water in tall trees or thickets.		Great Egret $_{B, M}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Tidal	Emergent	> 1 ha.	Similar wetlands are nearby.	Presence of >1 ha dense fine-leafed vegetation AND presence of >0.1 ha open water or aquatic bed.		Nests along edges of wetland.	Spotted Sandpiper $_{B,M}$
		Emergent			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher $_{B, M, W,1}$
	Lower Perennial	Rock Bottom	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$
		Rock Bottom	Moderately to large river.			Presence of large trees along banks separated from human disturbance AND overdominant trees separated from human disturbance present <3 km from wetland.	Water clear or moderately clear.	Bald Eagle $_{B, M, W,1}$
		Rock Bottom	Moderately to large river.			Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Lower Perennial	Rock Bottom			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		Rock Bottom			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1
		Rock Bottom	Presence of > 0.1 ha open water or aquatic bed.			Presence of exposed eroded banks.		Bank Swallow B, M
		Rock Bottom		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow B, M
		Unconsolidated Bottom	Large river.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull B, M, W
		Unconsolidated Bottom	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser B, M

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Lower Perennial	Unconsolidated Bottom	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard [B, M, W,1]
		Unconsolidated Bottom		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck [B, M, W,1]
		Unconsolidated Bottom	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall [B, M,1]
		Unconsolidated Bottom	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal [B, M,1]
		Unconsolidated Bottom	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal [B, M,1]
		Unconsolidated Bottom	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail [B, M,1]

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Lower Perennial	Unconsolidated Bottom	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Unconsolidated Bottom			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,1}$
		Unconsolidated Bottom			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Unconsolidated Bottom	Moderately to large river.			Presence of large trees along banks separated from human disturbance AND overdominant trees separated from human disturbance present <3 km from wetland.	Water clear or moderately clear.	Bald Eagle $_{B, M, W,1}$
		Unconsolidated Bottom	Moderately to large river.			Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Lower Perennial	Unconsolidated Bottom			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		Unconsolidated Bottom			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1
		Unconsolidated Bottom	Presence of > 0.1 ha open water or aquatic bed.			Presence of exposed eroded banks.		Bank Swallow B, M
		Unconsolidated Bottom		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow B, M
		Aquatic Bed	Large river.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull B, M, W
		Aquatic Bed	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser B, M

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Lower Perennial	Aquatic Bed	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard B, M, W,1
		Aquatic Bed		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck B, M, W,1
		Aquatic Bed	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall B, M,1
		Aquatic Bed	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal B, M,1
		Aquatic Bed	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal B, M,1
		Aquatic Bed	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail B, M,1

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Lower Perennial	Aquatic Bed	> 1 ha.		Presence of > 0.1 ha of emergent vegetation and > 0.1 ha of aquatic bed that are semi-permanently flooded and presence of trees >30 cm dbh	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Aquatic Bed			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,1}$
		Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Aquatic Bed	Moderately to large river.			Presence of large trees along banks separated from human disturbance AND overdominant trees separated from human disturbance present <3 km from wetland.	Water clear or moderately clear.	Bald Eagle $_{B, M, W,1}$
		Aquatic Bed	Moderately to large river.			Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Lower Perennial	Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1
		Aquatic Bed			Presence of > 0.1 ha open water or aquatic bed.		Presence of exposed eroded banks.	Bank Swallow B, M
		Aquatic Bed		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow B, M
		Rocky Shore	Large river.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull B, M, W
		Rocky Shore		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck B, M, W,1

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Lower Perennial	Rocky Shore	> 1 ha.	Similar wetlands are nearby.	Presence of >1 ha dense fine-leafed vegetation AND presence of >0.1 ha open water or aquatic bed.		Nests along edges of wetland.	Spotted Sandpiper $_{B,M}$
		Rocky Shore		Presence of fast-flow permanent stream in forested area.			Nest adjacent to the wetland on stream bank.	Louisiana Waterthrush $_{B, M}$
		Unconsolidated Shore	Large river.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull $_{B, M, W}$
		Unconsolidated Shore	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$
		Unconsolidated Shore	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,1}$
		Unconsolidated Shore		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck $_{B, M, W,1}$
		Unconsolidated Shore	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Lower Perennial	Unconsolidated Shore	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,1}$
		Unconsolidated Shore	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,1}$
		Unconsolidated Shore	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,1}$
		Unconsolidated Shore	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Unconsolidated Shore			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Lower Perennial	Unconsolidated Shore			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Unconsolidated Shore				Nests near water in tall trees or thickets.		Great Egret $_{B, M}$
		Unconsolidated Shore			Presence of > 0.5 ha of persistent emergent vegetation flooded 5-50 cm deep.		Nest concealed among grasses or sometimes on tussocks of grass or sedge on dry ground.	Common Snipe $_{B, M}$
		Unconsolidated Shore	> 1 ha.	Similar wetlands are nearby.	Presence of >1 ha dense fine-leafed vegetation AND presence of >0.1 ha open water or aquatic bed.		Nests along edges of wetland.	Spotted Sandpiper $_{B,M}$
		Unconsolidated Shore		Shrub layer is adjacent to open water or aquatic bed.		Presence of > 1 ha live shrub vegetation or forested with shrub understory.	Shrub layer is adjacent to open water or aquatic bed.	Northern Waterthrush $_{B, M}$
		Unconsolidated Shore		Presence of fast-flow permanent stream in forested area.			Nest adjacent to the wetland on stream bank.	Louisiana Waterthrush $_{B, M}$
		Emergent	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Lower Perennial	Emergent	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,1}$
		Emergent		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck $_{B, M, W,1}$
		Emergent	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,1}$
		Emergent	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,1}$
		Emergent	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,1}$
		Emergent	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Lower Perennial	Emergent	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Emergent			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher $_{B, M, W,1}$
		Emergent			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,1}$
		Emergent			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Emergent				Nests near water in tall trees or thickets.		Great Egret $_{B, M}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Upper Perennial	Rock Bottom			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		Rock Bottom			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1
		Rock Bottom	Presence of > 0.1 ha open water or aquatic bed.			Presence of exposed eroded banks.		Bank Swallow B, M
		Rock Bottom		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.	Bridges, pipe openings, or earthen banks adjacent for nesting.		Northern Rough-winged Swallow B, M
		Unconsolidated Bottom			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		Unconsolidated Bottom			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Upper Perennial	Unconsolidated Bottom	Presence of > 0.1 ha open water or aquatic bed.			Presence of exposed eroded banks.		Bank Swallow B, M
		Unconsolidated Bottom		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow B, M
		Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1
		Aquatic Bed			Presence of > 0.1 ha open water or aquatic bed.		Presence of exposed eroded banks.	Bank Swallow B, M
		Aquatic Bed		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow B, M
		Rocky Shore		Presence of fast-flow permanent stream in forested area.			Nest adjacent to the wetland on stream bank.	Louisiana Waterthrush B, M
		Unconsolidated Shore		Shrub layer is adjacent to open water or aquatic bed.		Presence of > 1 ha live shrub vegetation or forested with shrub understory.	Shrub layer is adjacent to open water or aquatic bed.	Northern Waterthrush B, M

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Riverine	Upper Perennial	Unconsolidated Shore		Presence of fast-flow permanent stream in forested area.			Nest adjacent to the wetland on stream bank.	Louisiana Waterthrush $_{B, M}$
	Intermittent	Streambed			Presence of > 0.5 ha of persistent emergent vegetation flooded 5-50 cm deep.		Nest concealed among grasses or sometimes on tussock of grass or sedge on dry ground.	Common Snipe $_{B, M}$
		Streambed	> 1 ha.	Similar wetlands are nearby.	Presence of >1 ha dense fine-leafed vegetation AND presence of >0.1 ha open water or aquatic bed.		Nests along edges of wetland.	Spotted Sandpiper $_{B,M}$
		Streambed		Shrub layer is adjacent to open water or aquatic bed.		Presence of > 1 ha live shrub vegetation or forested with shrub understory.	Shrub layer is adjacent to open water or aquatic bed.	Northern Waterthrush $_{B, M}$
		Streambed		Presence of fast-flow permanent stream in forested area.			Nest adjacent to the wetland on stream bank.	Louisiana Waterthrush $_{B, M}$
Lacustrine	Limnetic	Aquatic Bed	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Aquatic Bed			Presence of > 5 ha of open water OR aquatic bed OR > 2 ha of each.	Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Limnetic	Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		All limnetic classes (includes Rock Bottom, Unconsolidated Bottom and Aquatic Bed)	Presence of > 30 ha of open water.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull B, M, W
		All limnetic classes (includes Rock Bottom, Unconsolidated Bottom and Aquatic Bed)	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.		Hooded Merganser B, M
		All limnetic classes (includes Rock Bottom, Unconsolidated Bottom and Aquatic Bed)	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard B, M, W,1

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Limnetic	All limnetic classes (includes Rock Bottom, Unconsolidated Bottom and Aquatic Bed)	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,l}$
		All limnetic classes (includes Rock Bottom, Unconsolidated Bottom and Aquatic Bed)	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,l}$
		All limnetic classes (includes Rock Bottom, Unconsolidated Bottom and Aquatic Bed)	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,l}$
		All limnetic classes (includes Rock Bottom, Unconsolidated Bottom and Aquatic Bed)	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,l}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Limnetic	All limnetic classes (includes Rock Bottom, Unconsolidated Bottom and Aquatic Bed)			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose B, M, W,1
		All limnetic classes (includes Rock Bottom, Unconsolidated Bottom and Aquatic Bed)			Presence of > 10 ha of open water OR aquatic bed OR > 5 ha of each.	Presence of large trees along banks separated from human disturbance AND overdominant trees separated from human disturbance present <3 km from wetland.	Water clear or moderately clear.	Bald Eagle B, M, W,1
		All limnetic classes (includes Rock Bottom, Unconsolidated Bottom and Aquatic Bed)			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1
		All limnetic classes (includes Rock Bottom, Unconsolidated Bottom and Aquatic Bed)			Presence of > 0.1 ha open water or aquatic bed.		Presence of exposed eroded banks.	Bank Swallow B, M

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Limnetic	All limnetic classes (includes Rock Bottom, Unconsolidated Bottom and Aquatic Bed)		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow $_{B, M}$
	Littoral	Rock Bottom	Presence of > 30 ha of open water.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull $_{B, M, W}$
		Rock Bottom	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$
		Rock Bottom	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,1}$
		Rock Bottom	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,1}$
		Rock Bottom	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,1}$
		Rock Bottom	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Littoral	Rock Bottom	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail B, M,1
		Rock Bottom			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose B, M, W,1
		Rock Bottom			Presence of > 10 ha of open water OR aquatic bed OR > 5 ha of each.	Presence of large trees along banks separated from human disturbance AND overdominant trees separated from human disturbance present <3 km from wetland.	Water clear or moderately clear.	Bald Eagle B, M, W,1
		Rock Bottom			Presence of > 5 ha of open water OR aquatic bed OR > 2 ha of each.	Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey B, M,1

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Littoral	Rock Bottom			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		Rock Bottom			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1
		Rock Bottom			Presence of > 0.1 ha open water or aquatic bed.		Presence of exposed eroded banks.	Bank Swallow B, M
		Rock Bottom		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow B, M
		Unconsolidated Bottom	Presence of > 30 ha of open water.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull B, M, W
		Unconsolidated Bottom	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser B, M
		Unconsolidated Bottom	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard B, M, W,1

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Littoral	Unconsolidated Bottom	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,1}$
		Unconsolidated Bottom	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,1}$
		Unconsolidated Bottom	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,1}$
		Unconsolidated Bottom	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,1}$
		Unconsolidated Bottom	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Littoral	Unconsolidated Bottom			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose B, M, W,1
		Unconsolidated Bottom			Presence of > 10 ha of open water OR aquatic bed OR > 5 ha of each.	Presence of large trees along banks separated from human disturbance AND overdominant trees separated from human disturbance present <3 km from wetland.	Water clear or moderately clear.	Bald Eagle B, M, W,1
		Unconsolidated Bottom			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		Unconsolidated Bottom			Presence of > 5 ha of open water OR aquatic bed OR > 2 ha of each.	Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey B, M,1
		Unconsolidated Bottom			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1
		Unconsolidated Bottom			Presence of > 0.1 ha open water or aquatic bed.		Presence of exposed eroded banks.	Bank Swallow B, M

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Littoral	Unconsolidated Bottom		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow $_{B, M}$
		Aquatic Bed	Presence of > 30 ha of open water.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull $_{B, M, W}$
		Aquatic Bed	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$
		Aquatic Bed	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,1}$
		Aquatic Bed	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,1}$
		Aquatic Bed	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,1}$
		Aquatic Bed	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Littoral	Aquatic Bed	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,1}$
		Aquatic Bed	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Aquatic Bed			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,1}$
		Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Littoral	Aquatic Bed			Presence of > 10 ha of open water OR aquatic bed OR > 5 ha of each.	Presence of large trees along banks separated from human disturbance AND overdominant trees separated from human disturbance present <3 km from wetland.	Water clear or moderately clear.	Bald Eagle B, M, W,1
		Aquatic Bed			Presence of > 5 ha of open water OR aquatic bed OR > 2 ha of each.	Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey B, M,1
		Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1
		Aquatic Bed			Presence of > 0.1 ha open water or aquatic bed.		Presence of exposed eroded banks.	Bank Swallow B, M
		Aquatic Bed		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow B, M

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Littoral	Rocky Shore	Presence of > 30 ha of open water.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull $_{B, M, W}$
		Rocky Shore	> 1 ha.	Similar wetlands are nearby.	Presence of >1 ha dense fine-leafed vegetation AND presence of >0.1 ha open water or aquatic bed.		Nests along edges of wetland.	Spotted Sandpiper $_{B,M}$
		Unconsolidated Shore	Presence of > 30 ha of open water.				Nest adjacent to wetland on grassy hummock, sparsely vegetated rip-rap, rocky cliffs, and islands.	Herring Gull $_{B, M, W}$
		Unconsolidated Shore	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$
		Unconsolidated Shore	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,I}$
		Unconsolidated Shore	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,I}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Littoral	Unconsolidated Shore	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,1}$
		Unconsolidated Shore	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,1}$
		Unconsolidated Shore	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,1}$
		Unconsolidated Shore	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Unconsolidated Shore			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Littoral	Unconsolidated Shore			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Unconsolidated Shore				Nests near water in tall trees or thickets.		Great Egret $_{B, M}$
		Unconsolidated Shore			Presence of > 0.5 ha of persistent emergent vegetation flooded 5-50 cm deep.		Nest concealed among grasses or sometimes on tussock of grass or sedge on dry ground.	Common Snipe $_{B, M}$
		Unconsolidated Shore	> 1 ha.	Similar wetlands are nearby.	Presence of >1 ha dense fine-leafed vegetation AND presence of >0.1 ha open water or aquatic bed.		Nests along edges of wetland.	Spotted Sandpiper $_{B,M}$
		Emergent	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$
		Emergent	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,I}$
		Emergent	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,I}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Littoral	Emergent	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal B, M,1
		Emergent	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal B, M,1
		Emergent	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail B, M,1
		Emergent	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck B, M,1
		Emergent			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose B, M, W,1

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Lacustrine	Littoral	Emergent			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Emergent				Nests near water in tall trees or thickets.		Great Egret $_{B, M}$
		Emergent						Spotted Sandpiper $_{B,M}$
		Emergent			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher $_{B, M, W,1}$
Lacustrine		Any Lacustrine class above.		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck $_{B, M, W,1}$
Palustrine	(The palustrine system has no subsystems)	Rock Bottom	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser $_{B, M}$
		Rock Bottom	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Rock Bottom		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck B, M, W,1
		Rock Bottom	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall B, M,1
		Rock Bottom	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal B, M,1
		Rock Bottom	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal B, M,1
		Rock Bottom	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail B, M,1
		Rock Bottom			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose B, M, W,1

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Rock Bottom			Presence of > 5 ha of open water OR aquatic bed OR > 2 ha of each.	Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey B, M,1
		Rock Bottom			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		Rock Bottom			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1
		Rock Bottom			Presence of > 0.1 ha open water or aquatic bed.		Presence of exposed eroded banks.	Bank Swallow B, M
		Rock Bottom		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow B, M
		Unconsolidated Bottom	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser B, M
		Unconsolidated Bottom	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard B, M, W,1

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Unconsolidated Bottom		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck B, M, W,1
		Unconsolidated Bottom	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall B, M,1
		Unconsolidated Bottom	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal B, M,1
		Unconsolidated Bottom	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal B, M,1
		Unconsolidated Bottom	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail B, M,1
		Unconsolidated Bottom	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck B, M,1

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Unconsolidated Bottom			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose B, M, W,1
		Unconsolidated Bottom			Presence of > 5 ha of open water OR aquatic bed OR > 2 ha of each.	Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey B, M,1
		Unconsolidated Bottom			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		Unconsolidated Bottom			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1
		Unconsolidated Bottom			Presence of > 0.1 ha open water or aquatic bed.		Presence of exposed eroded banks.	Bank Swallow B, M
		Unconsolidated Bottom		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow B, M
		Aquatic Bed	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser B, M

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Aquatic Bed	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard [B, M, W,1]
		Aquatic Bed		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck [B, M, W,1]
		Aquatic Bed	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall [B, M,1]
		Aquatic Bed	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal [B, M,1]
		Aquatic Bed	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal [B, M,1]
		Aquatic Bed	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail [B, M,1]

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Aquatic Bed	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Aquatic Bed			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,1}$
		Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Aquatic Bed			Presence of > 5 ha of open water OR aquatic bed OR > 2 ha of each.	Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher B, M, W,1
		Aquatic Bed			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow B, M,1
		Aquatic Bed			Presence of > 0.1 ha open water or aquatic bed.		Presence of exposed eroded banks.	Bank Swallow
		Aquatic Bed		Bridges, pipe openings, or earthen banks adjacent for nesting.	Presence of > 0.1 ha open water or aquatic bed.		Bridges, pipe openings, or earthen banks adjacent for nesting.	Northern Rough-winged Swallow B, M
		Unconsolidated Shore	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser B, M
		Unconsolidated Shore	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard B, M, W,1
		Unconsolidated Shore		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck B, M, W,1

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Unconsolidated Shore	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall $_{B, M,1}$
		Unconsolidated Shore	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,1}$
		Unconsolidated Shore	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal $_{B, M,1}$
		Unconsolidated Shore	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,1}$
		Unconsolidated Shore	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Unconsolidated Shore			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose B, M, W,I
		Unconsolidated Shore			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron B, M, W
		Unconsolidated Shore				Nests near water in tall trees or thickets.		Great Egret B, M
		Unconsolidated Shore			Presence of > 0.5 ha of persistent emergent vegetation flooded 5-50 cm deep.		Nest concealed among grasses or sometimes on tussock of grass or sedge on dry ground.	Common Snipe B, M
		Unconsolidated Shore	> 1 ha.	Similar wetlands are nearby.	Presence of >1 ha dense fine-leafed vegetation AND presence of >0.1 ha open water or aquatic bed.		Nests along edges of wetland.	Spotted Sandpiper B,M
		Unconsolidated Shore		Shrub layer is adjacent to open water or aquatic bed.		Presence of > 1 ha live shrub vegetation or forested with shrub understory.	Shrub layer is adjacent to open water or aquatic bed.	Northern Waterthrush B, M

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

		Moss Lichen			Presence of > 0.5 ha of persistent emergent vegetation flooded 5-50 cm deep.		Nest concealed among grasses or sometimes on tussock of grass or sedge on dry ground.	Common Snipe B, M

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Emergent	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.	Water clear or moderately clear.	Hooded Merganser [B, M]
		Emergent	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard [B, M, W,1]
		Emergent		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck [B, M, W,1]
		Emergent	> 5 ha		Presence of >1 ha of aquatic bed AND > 1 ha of emergent vegetation.	Presence of herbaceous cover > 30 cm tall < 100 m from the wetland.		Gadwall [B, M,1]
		Emergent	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal [B, M,1]
		Emergent	> 1 ha.		Presence of >0.1 ha emergent vegetation and > 0.1 ha aquatic bed vegetation	Herbaceous vegetation 30 cm tall or scrub/shrub cover <100 m away.		Blue-winged Teal [B, M,1]

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Emergent	> .5 ha		> 0.1 ha of aquatic bed vegetation present AND > 0.1 ha of emergent vegetation present.	Fine leafed herbaceous cover present <100 m from wetland.	Aquatic bed OR emergent vegetation at least flooded semipermanently in duration AND water < 25 cm deep in aquatic bed.	Northern Pintail $_{B, M,1}$
		Emergent	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Emergent			Presence of > 2 ha or open water OR aquatic bed OR > 1 ha of each AND > 1 ha of emergent vegetation.		Presence of permanent water with depths between 10 and 25 cm within open water OR aquatic bed. Upland nesters up to 150 ft. away on an elevated site.	Canada Goose $_{B, M, W,1}$
		Emergent			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Emergent				Nests near water in tall trees or thickets.		Great Egret $_{B, M}$
		Emergent			Presence of > 0.5 ha of persistent emergent vegetation flooded 5-50 cm deep.		Nest concealed among grasses or sometimes on tussock of grass or sedge on dry ground.	Common Snipe $_{B, M}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Emergent	> 1 ha.	Similar wetlands are nearby.	Presence of >1 ha dense fine-leafed vegetation AND presence of >0.1 ha open water or aquatic bed.		Nests along edges of wetland.	Spotted Sandpiper $_{B,M}$
		Emergent			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep.		Presence of clear water AND presence of > 1 km of lake shoreline or open stream AND shallow water areas unobstructed from above AND presence of eroded bank.	Belted Kingfisher $_{B, M, W,1}$
		Scrub Shrub	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,1,1}$
		Scrub Shrub		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck $_{B, M, W,1}$
		Scrub Shrub	>2 ha		Presence of > 0.1 ha of emergent vegetation AND presence of >0.1 ha aquatic bed vegetation that is 5-100 cm deep.	Fine leafed emergent nesting cover present <30 m from wetland.		Green-winged Teal $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Scrub Shrub	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Scrub Shrub			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Scrub Shrub			Presence of > 0.5 ha of persistent emergent vegetation flooded 5-50 cm deep.		Nest concealed among grasses or sometimes on tussock of grass or sedge on dry ground.	Common Snipe $_{B, M}$
		Scrub Shrub		Shrub layer is adjacent to open water or aquatic bed.		Presence of > 1 ha live shrub vegetation or forested with shrub understory.	Shrub layer is adjacent to open water or aquatic bed.	Northern Waterthrush $_{B, M}$
		Scrub Shrub		Adjacent to stream, pond, or other waterbody.	Forest with dense understory within or adjacent to wetland.	Forest with dense understory within or adjacent to wetland.	Nest on or near ground, usually in the vicinity of water.	Canada Warbler $_{B, M}$
		Forested	> 2 ha.		Presence of > 1 ha aquatic bed vegetation.	Presence of dead trees >30 cm dbh or functional nest boxes.		Hooded Merganser $_{B, M}$
		Forested	> 1 ha.		Presence of > 0.5 ha of emergent vegetation that is flooded 5-50 cm deep at least semi-permanently.		Upland nesters within 300 ft. of water.	Mallard $_{B, M, W,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Forested		Nearby permanent water with connecting channel present OR aquatic bed or open water is permanent.	Presence of > 0.1 ha open water or aquatic bed that is > 10 cm deep.	Some scrub/shrub or herbaceous cover for nesting < 30 m from wetland.	pH >5.0 AND water level relatively stable.	American Black Duck $_{B, M, W,1}$
		Forested	> 1 ha.		Presence of > 0.1 ha of emergent vegetation AND > 0.1 ha of aquatic bed (with water that is 5-50 cm deep) that are semi-permanently flooded.	Presence of dead trees >30 cm dbh or functional nest boxes.	For brooding: water depth in aquatic bed 5-50 cm and any flowing water < 2 km/h.	Wood Duck $_{B, M,1}$
		Forested			Presence of > 0.1 ha of open water or aquatic bed < 50 cm deep AND tall trees adjacent to or within wetland for nesting.	Tall trees adjacent to or within wetland for nesting.	Presence of great blue heron nests AND water moderately clear or clear in areas with little human disturbance.	Great Blue Heron $_{B, M, W}$
		Forested			Presence of > 10 ha of open water OR aquatic bed OR > 5 ha of each.	Presence of large trees along banks separated from human disturbance AND overdominant trees separated from human disturbance present <3 km from wetland.	Water clear or moderately clear.	Bald Eagle $_{B, M, W,1}$
		Forested	Presence of > 5 ha of open water OR aquatic bed OR > 2 ha of each.			Overdominant trees separated from human disturbance < 3 km from wetland.	Water clear or moderately clear.	Osprey $_{B, M,1}$
		Forested			Presence of > 0.1 ha of open water or aquatic bed.	Presence of dead trees dbh > 15 cm OR functional nest boxes.		Tree Swallow $_{B, M,1}$

WETLAND HABITAT PREDICTORS FOR THE 100 FT. BUFFER ZONE - BIRDS

WETLAND SYSTEM	WETLAND SUBSYSTEM	WETLAND CLASS	WETLAND SIZE	JUXTAPOSITION	WETLAND VEGETATION	UPLAND VEGETATION IN 100 ft. BUFFER ZONE	ADDITIONAL SPECIFIC NESTING REQUIREMENTS	DEPENDENT SPECIES
Palustrine	(The palustrine system has no subsystems)	Forested		Shrub layer is adjacent to open water or aquatic bed.		Presence of > 1 ha live shrub vegetation or forested with shrub understory.	Shrub layer is adjacent to open water or aquatic bed.	Northern Waterthrush [B, M]
		Forested		Presence of fast-flow permanent stream in forested area.			Nest adjacent to the wetland on stream bank.	Louisiana Waterthrush [B, M]
		Forested		Adjacent to stream, pond, or other waterbody.	Forest with dense understory within or adjacent to wetland.	Forest with dense understory within or adjacent to wetland.	Nest on or near ground, usually in the vicinity of water.	Canada Warbler [B, M]

1. Species uses areas beyond the 100 ft. buffer zone.

B= breeding, W=wintering, M=migratory

APPENDIX G

Distance Traveled from the Wetland

- *Reptiles, Amphibians, Birds and Mammals* -

Distance Travelled from Wetland

Reptile	*Distance From Wetland*	*Reference*	*Uses Wetland Edge to 200 ft. ?*	*Uses Edge to Beyond 200 ft.?*
Spotted Turtle	250 m across terrestrial habitats for foraging and hibernacula.	Ernst, 1976	y	y
	50 m from water for nesting.	Ernst, 1976		
	Move up to 2,750 m overland between aquatic habitat searching for mates.	Lovich, 1990		
	Aestivate in upland forests from 13-412 m (average 178 m) from permanent wetland edges.	Milam, 1997 (DeGraaf and Yamasaki, 2001)		
	Females move overland to nest in upland fields from 75-312m (average 182 m).	Milam, 1997 (DeGraaf and Yamasaki, 2001)		
Wood Turtle	Nesting 100-200 m from water in dry open field or road embankment.	Carroll and Ehrenfeld, 1978	y	y
	Most adults remain within 15 m of stream; never move more than 150 m overland.	Harding and Bloomer, 1979		
	100-400 m from waterbody for movement.	Ernst, 1986		
	Movement: within 300 m of creek, occasionally up to 600m	Kaufmann, 1992		
Blanding's Turtle	2-1115 m (avg=135) from nearest water for nesting.	Congdon et al., 1983	y	y
	Distance travelled from water : female avg. =168 m, male avg= 620 m	Ross and Anderson, 1990		
	Female distance travelled to nest from activity center avg = 246 m	Ross and Anderson, 1990		
	Nest in plowed fields within 675 m of wetlands.	Ross and Anderson, 1990		
	Nest 650-900 m from home pond.	Rowe and Moll, 1991		
	Move up to 2 km from home wetland; generally <500 m.	Joyall, unpublished data		
	Move up to 1 km between wetlands of varying types.	Haskins, unpublished data		
Painted Turtle	>100 m (15 of 100) and >400 m (16 of 100) movement	Gibbons, 1968	y	y
	Spring migration 1,080 m from origin, up to 120 m over grassland.	Sexton, 1959		
	Up to .81 km from wetland for nesting.	Tyning pers. Comm. In DeGraaf and Rudis, 1986		
	Nest sites distance from water 1-164 m avg=60m.	Congdon and Gatten, 1989		

Distance Travelled from Wetland

Reptile	*Distance From Wetland*	*Reference*	*Uses Wetland Edge to 200 ft. ?*	*Uses Edge to Beyond 200 ft.?*
Common Musk Turtle	Nest site 12.2 m from stream.	Minton, 1972	n	n
	Nesting in loamy soil 3-11 m from water.	Ernst, 1986		
	Moved .64 km and .70 km in drought.	Gibbions et al., 1983		
Plymouth Redbelly Turtle	Females select nesting sites in sandy soil, generally within 295.3 ft (90 m) of the pond.	U.S. Fish and Wildlife Service, 1994	y	y
Common Snapping Turtle	Move for nesting up to 13.8 km from resident wetland.	Obbard and Brooks, 1980	y	y
	Nest distance from permanent water:1-183 m, avg. = 37.1 m	Congdon et al., 1987		
	Distance travelled overland 500m-1625m, avg = 1000m	Congdon et al., 1987		
Northern Water Snake	Animals typically found within 10 m of water's edge.	King, 1986	n	n
	Animals never found >6 m from water's edge.	Tiebout and Carey, 1987		
Ribbon Snake	Extensive open areas without bodies of water would act as a barrier.	Carpenter, 1953	u	u
	Well-drained grassy areas adjacent to marsh used for basking.	Carpenter, 1953		
	Found in highly disturbed as well as undisturbed areas.	Klemens, 1993 (DeGraaf and Yamasaki, 2001)		

Distance Travelled From Wetland

Amphibians	*Distance From Wetland*	*Reference*	*Uses Wetland Edge to 200 ft. ?*	*Uses Edge to Beyond 200 ft.?*
Marbled Salamander	Mean 194 m, range 0-450 m from pond	Williams, 1973	y	y
Jefferson Salamander	21m, 27m, 107m, from breeding pond	Wacasey, 1961	y	y
	Found up to 152 m from breeding pond	Wacasey, 1961		
	92 +/- 80.8 m, range 3-247 m distance traveled by metamorphs.	Williams, 1973		
	252+/- 136 m, range 20-625 m distance traveled by adults	Williams, 1973		
	< 75 m from breeding pond; all adults movements	Wilson, 1976		
	< 75 m from breeding pond; all juveniles movements	Wilson, 1976		
	250 m distance traveled by adults	Douglas and Monroe, 1981		
Blue Spotted Salamander	The mean distance traveled from the breeding pond was observed to be 656 ft.	Windmiller, 1996	y	y
Spotted Salamander	26 m; 107 m from breeding pond; adults found	Wacasey, 1961	y	y
	Found up to 152 m from breeding pond	Wacasey, 1961		
	> 300 m from nearest pond; juvenile found	Wacasey, 1961		
	Woodland 35-100 m from pond; population site	Shoop, 1965		
	823, 18, 400, 457 m from breeding pond adults found	Gordon, 1968		
	64.2+/-37 m, range 0-125 m adult migratory distance	Williams, 1973		
	< 75 m from breeding pond; all adults movements	Wilson, 1976		
	< 75 m from breeding pond; all juveniles movements	Wilson, 1976		
	Mean 150 m, range 6-220 m; adult migratory distance	Douglas and Monroe, 1981		
	Mean 192+/- 12.8 m from pond, range 157-249 m adult migratory distance	Kleeberger and Werner, 1983		
Red-Spotted Newt	Efts move up to 800 m from breeding pond	Healy, 1975	y	y
Four-toed Salamander	Nests located next to and just above water, usually below or within moss mats.	Bishop, 1941 (DeGraaf and Yamasaki, 2001)	u	u

Distance Travelled From Wetland

Amphibians	*Distance From Wetland*	*Reference*	*Uses Wetland Edge to 200 ft. ?*	*Uses Edge to Beyond 200 ft.?*
Dusky Salamander	6.1 m from open water	Organ, 1961	n	n
	3 m from bank	Barbour et al., 1969		
	17.1 m upstream; distance traveled in 24 h	Barbour et al., 1969		
	15-90 cm from open water	Krysik, 1979		
	mean distance from open water 64.8 cm. Range 30-99 cm; nest sites	Jones, 1986		
Two lined Salamander	Average distance traveled from stream 65 m; max distance >100 m	MacCulloch and Bider, 1975	y	y
Northern Spring Salamander	Found in wet soil near water.	DeGraaf and Yamasaki, 2001	u	u
Spadefoot Toad	Ponds 107-402 m from home range - movements for breeding.	Pearson, 1955	y	y
	61 m, 37.5m, 38.1m, 76.2 m; dispersal distances	Pearson, 1955		
	30.5m, 215m from natal pond	Neill 1957		
American Toad	Adult seasonal movements up to 1 km.	Blair, 1943, Oldham, 1966 and Ewert, 1969	y	y
	85, 90, 120m, Adult movements	Dole,1972		
	Adapted to suburban and agricultural areas.	Minton, 1972		
Fowler's Toad	Median distance dispersed: juveniles 174 m, juvenile - subadult 25 m, sub-adult - adult 25 m, adults 29 m for dispersal.	Breden, 1987	y	y
	Travel to pond 312 m away from home range	Clarke, 1974a		
Grey Treefrog	Use bushes or small trees adjacent to ponds for breeding found within 3 m of water's edge.	Ptacek, 1992	u	u
	Often found at a great distance from the closest wetland or water body.	Pers. Com. Scott Jackson, University of Massachusetts.		
Spring Peeper	Overwinter terrestrially using moist woodlands	Wright and Wright, 1949	y	y
	Travel up to 40 m in daily movements.	Delzell, 1958		
	Fall movements are up to 300 m	Davis, 1992		

Distance Travelled From Wetland

Amphibians	*Distance From Wetland*	*Reference*	*Uses Wetland Edge to 200 ft. ?*	*Uses Edge to Beyond 200 ft.?*
Bullfrog	Adults can migrate to other ponds, but maximum distances are unknown.	Graves and Anderson, 1987	n	n
	Found bullfrogs to have a mean daily activity radius of 2.6 m (8.5 ft) with a range of 0.61-11.3 m (2 -37.1 ft.).	Currie and Bellis 1969		
Green Frog	Seldom moves more than 32.8 ft. (10 m) from the water's edge except for breeding.	Martof, 1953a	n	n
	Movement to and from breeding site - 300 m.	Martof, 1953a		
Wood Frog	Most frogs found <100 m from water, mean 50m	Roberts and Lewin, 1979	y	y
	Average dispersal distance from natal pond 1,169 +/- 351 m to breeding pond	Berven and Grudzien, 1990		
Northern Leopard Frog	Frogs found 0-18 (90), 19-36 (9), 37-54 (12), 55-73 (1)	Whitaker, 1961	y	n
	Juvenile emigration > 300 m across cropland, roads, hills, and deep grass	Bovberg and Bovberg, 1964		
	Dry field between wet woods and marsh not a travel barrier after rains	Dole, 1965a		
	Juveniles will travel through 400 m of dry upland woods	Dole, 1971		
	Juvenile dispersal distances 800 m, 1.2-1.6 km, 5.2 km	Dole, 1971		
Pickerel Frog	Often found in wet pastures, fields, rocky ravines, or woodlands, often at a distance from water.	Degraaf and Yamasaki, 2001	u	u

Distance Travelled from Wetland

Birds	*Distance From Wetland*	*Reference*	*Uses Wetland Edge to 200 ft. ?*	*Uses Edge to Beyond 200 ft.?*
Herring Gull	On grassy hummocks, drift adjacent to salt marshes, rock terraces, rocky cliffs, tall clumps of vegetation, marine terraces and beaches above high tide, and on rooftops.	DeGraaf and Rappole, 1995 (DeGraaf and Yamasaki, 2001)	u	u
Hooded Merganser	Nests in tree cavities or nest boxes, prefers those in or near the water.	Morse et al., 1969 in DeGraaf and Yamasaki, 2001	u	u
Mallard	Typically nests on ground in dry or slightly marshy areas within 300 ft. of water.	DeGraaf and Yamasaki, 2001	y	y
	Nests 3-50 ft. from water	Miller & Collins,1954		
American Black Duck	Generally nest in a hollow on dry ground in a site that is slightly elevated and well hidden in grasses, shrubs, or briers.	DeGraaf and Yamasaki, 2001	y	y
	Upland nests may be a mile or more from water.	Palmer, 1976 in DeGraaf		
Gadwall	Nests on dry ground on islands in lakes, upland meadows or pastures, and on prairies, usually within 165 ft. from water.	DeGraaf and Yamasaki, 2001	y	n
	85 % of nests 3-50 ft. from water	Miller and Collins, 1954		
Green -winged Teal	Nests in depressions on dry ground in dense grass, at the base of shrubs, or under a log, may be 400 m or more from the water, usually 1-91 m.	DeGraaf and Yamasaki, 2001	y	y
Blue-winged Teal	Nests in dense grassy sites or on the ground under bushes within a mile of the water's edge.	DeGraaf and Yamasaki, 2001	y	y
	Average distance nest to open water 256 m, none > 1000 m and usually within grassy vegetation.	Sousa, 1985		
Northern Pintail	They will nest up to a mile from water.	Bellrose, 1980 in DeGraaf and Yamasaki, 2001	y	y
	Nest in the upland in grasslands.	Andrle & Carroll, 1988		
	Fine-leafed nesting cover present <30 m from wetland.	Crawley et al., 1996		

Distance Travelled from Wetland

Birds	*Distance From Wetland*	*Reference*	*Uses Wetland Edge to 200 ft. ?*	*Uses Edge to Beyond 200 ft.?*
Wood Duck	Normally nest < .5 mi. from water, seldom >1 mile,	Flood et al., 1977	y	y
	Prefer natural cavities <500 m from water and near opening in forest canopy.	Dugger & Fredrickson, 1992		
Canada Goose	Nest typically near the water (up to 150 ft) preferably on a slightly elevated site, including beaver lodges, muskrat houses, old stumps, small islands, artificial platforms.	DeGraaf and Yamasaki, 2001	y	n
Great Blue Heron	Colonies are usually near water although herons may use upland sites away from water for nesting.	Short and Cooper, 1985	u	u
	Recommended 250 m buffer zone on land around heronries.	Vos et al., 1985		
	Most colonies were in upland deciduous forest (47 and 49%) or swamps (44 and 40%).	McCrimmon, 1981		
Great Egret	Nests near water in tall trees or thickets.	DeGraaf and Yamasaki, 2001	n	n
Common Snipe	Nest is concealed among grasses or other vegetation on dry ground, sometimes on a tussock of grass or sedge.	DeGraaf and Yamasaki, 2001	u	u
Spotted Sandpiper	Nests in hayfields, pastures, along banks of ponds and streams.	Bagg and Elliot, 1937	u	u
	Nest in grassy vegetaion near the water.	Andrle & Carroll, 1988		
	Prefers to feed along gravelly and stony margins of ponds and lakes.	Zeranski and Baptist, 1990		
Osprey	Overdominant trees separated from human disturbance present <3 km from wetland.	Crawley et al., 1996	y	y
	Suitable nest sites within 5 km waterbody.	Vana-Miller, 1987		
	Cut no timber within 70 m or water where osprey are nesting.	Zarn, 1974		

Distance Travelled from Wetland

Birds	*Distance From Wetland*	*Reference*	*Uses Wetland Edge to 200 ft. ?*	*Uses Edge to Beyond 200 ft.?*
Bald Eagle	Nest in large hardwoods within 700 m of shoreline.	Lanier and Foss, 1989	y	y
	Nests usually within < 200 m of water , but may be further.	Stalmaster, 1987		
	Overdominant trees separated from human disturbance present <3 km from wetland; presence of large trees along banks separated from human disturbance.	Crawley et al., 1996		
Belted Kingfisher	Two nests found over water, 3 were 500 ft. from lake, 4 were 0.3-1.0 miles from water .	Cornwell, 1963	y	y
	Nest in a burrow deep in a bank of sandy clay fairly near the water, but up to a mile from the water.	DeGraaf and Yamasaki, 2001		
Tree Swallow	Nests in cavities further (ave 48 m vs. 26 m) from shore more successful.	Rendell & Robertson, 1989	y	n
Bank Swallow	Nest in banks near lakes and rivers	Zeranski and Baptist, 1990	n	n
Northern Rough-winged Swallow	Nests near water under bridges, in pipe openings or in earthen banks	Zeranski and Baptist, 1990	n	n
Northern Waterthrush	Uses edges of swamps, ponds, streams, and muddy shores of woodland pools	Bent, 1953	n	n
	Some nest under upturned roots on shady rocky shorelines of n. lakes.	Sprunt, 1979		
Louisiana Waterthrush	Nest in banks and gullies near water.	Sprunt, 1979	n	n
	Nest near the top of the stream bank.	Andrle & Carroll, 1988		
Canada Warbler	Regular nester in wilder dense upgrown parts of swamp	Zeranski and Baptist, 1990	n	n
	Nest in the vicinity of a stream, pond, or other water body on or near the ground atop logs or stumps, amid fern stands, or in bank cavities.	(DeGraaf and Yamasaki, 2001).		

Distance Travelled From Wetland

Mammal	*Distance From Wetland*	*Reference*	*Uses Wetland Edge to 200 ft. ?*	*Uses Edge to Beyond 200 ft.?*
Water Shrew	Greatest distance from water for population site 18 cm.	Conaway, 1952	y	y
	Population site 24.4 m from edge of temporary pond	Layne and Shoop, 1971		
	Population site within several hundred meters of watercourse.	Wrigley et al., 1979		
Star-nosed Mole	One nest 7 m from stream	Rust, 1966	y	y
	One nest 7 m from stream	Hickman, 1983		
	One nest 100 m from water	Hickman, 1983		
Beaver	<100 m from open water and wetland main feeding habitat	Allen, 1983	y	y
	Foraging can occur several hundred feet from pond.	Howard and Larson, 1985		
Muskrat	Necessary food supply is dense herbaceous vegetation within 10 m of water's edge.	Allen and Hoffman, 1984	n	n
Masked Shrew	Trapped within 20 m of streams	Pagels and Tate, 1976	u	u
	No significant differences in abundance between pond-side and upland habitat.	Brooks and Doyle, 2001		
River Otter	Will den along watercourse using hollow logs, jumbles of loose rock, abandoned or unused structures.	Toweill and Tabor, 1982	n	n
Mink	Use forested log-strewn and thicketed areas within the upland for den sites.	Godin, 1977	u	u
	Upland areas with overhanging banks, boulders and rock crevices are used for foraging .	Allen, 1986		
Meadow Jumping Mouse	Depends upon thick stands of herbs and grasses that are supported by moist soils often found adjacent to wetlands .	Godin, 1977	u	u
Bats - Little Brown Myotis, Silver-haired Bat, Eastern Pipistrelle, Keen's Myotis and Small-footed Myotis	Known to fly as far as 12.4 miles (20 km) from roosting to foraging sites.	Fenton, 1989	y	y
Smoky Shrew	Typically near streams with moss-covered banks.	Burt and Grossensheider, 1976 in DeGraaf and Yamasaki, 2001	u	u