BOW WETLAND STUDY
AND
PRIME WETLANDS:
A USER'S GUIDE

December, 1989

Submitted to: Bow Conservation Commission
Town of Bow
Bow, New Hampshire 03304

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TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

IV. RECOMMENDATIONS

TABLES **PAGES**

BIBLIOGRPAHY

FIGURES

VOLUME II

I. INTRODUCTION

New England Environmental Associates, Inc. (NEEA) of Concord, New Hampshire contracted with the Bow Conservation Commission in the fall of 1988 to provide the following:

1. Inventory of wetlands within the Town of Bow. Wetland inventory to include all hydric soil units greater than 1 acre in size identified in the USDA-SCS Merrimack County Soil Survey, and any other areas less than one acre in size, if they are adjacent to another wetland area or stream; and/or if they are unique. The locations of wetlands less than 1 acre in size were to be identified by members of the Conservation Commission.

2. Preparation of Wetland Inventory Map at the scale of the town's base map (1"=1000'). Wetland map to include watershed boundaries; direction of flow in all perennial and most intermittent channels in Bow; wetland identification numbers and wetland classification codes.

3. Classification of wetlands according to the U.S. Fish and Wildlife Service methodology: "Classification of Wetlands and Deepwater Habitats of the United States; Dec., 1989: Cowardin, et.al".

4. Evaluation of wetland functions for selected wetlands with the potential for designation as "Prime" wetlands.

5. Assistance to the Conservation Commission in the "Prime" wetland selection process.

6. Drafting of "Prime" wetlands onto Bow tax maps.

The purpose of this study was to provide the Bow Conservation Commission with a data base for identified wetland systems in Bow. These data are intended to assist the Conservation Commission in their assessment of the potential impacts of dredge and fill activities; to improve the Conservation Commission's general knowledge of the wetland resources in town; and to improve the Conservation Commission's ability to educate landowners in town. A well informed Conservation Commission is better able to make consistent, well informed decisions regarding potential wetland impacts and effectively relay their concerns to the New Hampshire Wetlands Board and the Bow Planning Board.

II. INVENTORY AND CLASSIFICATION

Field work to inventory and collect data on wetlands within Bow began in April, 1989 and continued through July, 1989.

Methodology

SCS soil maps of Bow, town-owned aerial photos (1"=1000') and a town tax map (1"=1000') were used to locate the wetland areas in the field. Wetland characteristics, stream characteristics and other pertinent data were recorded on the field sheets. To the extent possible given limitations of map scale and time, wetland boundaries as mapped by the SCS were confirmed and/or adjusted to reflect changes due to dredge, fill and/or construction activities.

Adjacent wetland soil types not restricted from interacting hydrologically were considered to be one wetland and were assigned a number and classification code. Adjacent wetland soil types located on opposite sides of a significant hydrological constriction, either natural or man-made (ie. culvert, dam, etc.)

were considered to be separate wetlands, and assigned individual numbers.

Wetland classification codes were assigned using the U.S. Fish and Wildlife Service methodology, "Classification of Wetlands and Deepwater Habitats of the United States", Cowardin et al., 1979.

Upon completion of the field work, information collected in the field was used to complete the map "Bow Wetland Study". The map is at the scale of 1"=1000' and hence is considered accurate for planning purposes, but not for engineering or other purposes requiring site specific information. Further, the map only depicts those wetlands on hydric soils as shown on SCS soil maps, and thus is not intended to be a map of all wetlands in Bow. Smaller wetlands may exist as inclusions within other drier soil types and are not indicated on the SCS soils map. These wetland areas were not within the scope of this study. The locations of these wetlands are best identified by requiring a High Intensity Soil Survey on lands proposed for development.

Results

The field sheets completed in the inventory and classification portion of the study are in Appendix A, Volume II. Data contained on these sheets were used to compile the following information on soils, watersheds, wetland Systems and Classes and wetland hydrology.

Soils

Table 1 lists SCS hydric soil units which occur in Bow and were investigated as part of this study. The table also summarizes information by soil type regarding slope, soil

TABLE 1
CHARACTERISTICS OF HYDRIC SOIL SERIES IN BOW, NEW HAMPSHIRE[1]

Soil Type	Description	Slope	Drainage	pH	Typical Species	Hydrology
AgA	AuGres fine sandy loam	0-3%	Poorly	Strongly Acid	Red maple, white pine, speckled alder, gray birch	High water table in wet periods; rapid drainage if water table recedes; partially cemented pan (subsoil).
AuB	AuGres loamy sand	3-8%	Poorly	Strongly Acid	Red maple, white pine, speckled alder, gray birch	High water table in wet periods; rapid drainage if water table recedes.
Lm	Limerick silt loam	nearly level	Poorly	Strongly Acid	Red maple, elm, hemlock, speckled alder, white pine	High water table - slow drainage; finest textured soils in county (silts & clays).
RbA	Ridgebury loam	0-3%	Poorly	Strongly Acid	Red maple, elm, speckled alder, white pine, highbush blueberry	Glacial till - pan layer; saturated winter, fall, spring; slow drainage in summer.
RbB	Ridgebury loam	3-8%	Poorly	Strongly Acid	Red maple, elm speckled alder, white pine, highbush blueberry	Glacial till - pan layer; saturated winter, fall, spring; slow drainage in summer.

[1] Information in Table 1 condensed from Tables in the USDA-SCS Merrimack County Soil Survey.

TABLE 1
(CONTINUED)

Soil Type	Description	Slope	Drainage	pH	Typical Species	Hydrology
RdA	Ridgebury and Whitman very stony loams	0-3%	Very Poorly & Poorly	Strongly Acid	Red maple, elm speckled alder, white pine, highbush blueberry	Stones and boulders, pan layer; high water table - winter, fall, spring.
RdB	Ridgebury and Whitman very stony loams	3-8%	Poorly	Strongly Acid	Red maple, elm, speckled alder, white pine, highbush blueberry	Stones and boulders pan layer, high water table - winter, fall, spring.
Ru	Rumney fine sandy loam	flood-plain	Poorly	Medium to Strongly Acid	Red maple, elm, willow, alder	High water table; drainage rapid when water table lowers; occasional flooding.
Sa	Saco silt loam	flood-plain	Very Poorly	Strongly Acid	Alders, red maple elm, cattails, sedges, rushes	Flooded yearly; silty clay loam; sub-soil-recent alluvium.
Sc	Scarboro fine sandy loam	nearly level	Very Poorly	Stongly Acid	Red maple, elm, white pine, alder, highbush blueberry	Saturated most of year by high water table.
Mh	Marsh	level	Very Poorly		Grasses, reeds, sedges, cattails, rushes	Covered by shallow water most of the time.
Mp	Muck & Peat	level	Very Poorly	Extremely Acid	Mosses, sedges, reeds, highbush blueberry, cran-berry or Red maple, gray birch, white pine, black spruce hemlock, tamarack	Water table saturates surface most of the year; frequently flooded by runoff; high frost potential spring & fall.

drainage, soil pH, typical associated species and hydrological characteristics. This information was condensed from Tables in the USDA-SCS Merrimack County Soil Survey.

Approximately 150 hydric soil units were mapped by the SCS as occurring within the Town of Bow. Upon field investigation and assessment of hydrological interconnection, 104 discrete wetland areas were defined and numbered. These 104 include several additional wetland areas found during the field investigations and added to those mapped by the SCS. These 104 areas cover 2571 acres or approximately 13 percent of the total acreage (19,243 acres) in Bow.

Watersheds

All wetlands in Bow are part of the Merrimack River Principal Drainage Basin. Within Bow there are 5 watersheds all of which eventually drain to the Merrimack River.

These watersheds are the following:

1. Turkey River Watershed - 6,900 acres (23,000 acres)
2. Bow Bog Brook Watershed - 5,300 acres
3. Merrimack River Watershed (surface runoff directly into river) 3,500 acres.
4. Brickyard Brook Watershed - 1,000 acres (2,400 acres)
5. Black Brook Watershed - 2,400 acres (9,800 acres)

The acreage of each watershed within Bow is listed above. Where a watershed includes land outside of Bow, the total acreage of the watershed is listed in parentheses. The boundaries for each of these five watersheds are shown on the Bow Wetlands Study Map. The acreages for each watershed

were taken from the Water Resource Management and Protection Plan prepared for Bow in 1989 by the Central New Hampshire Regional Planning Commission.

Wetland Classification Codes

The USFWS methodology for the classification of wetlands classifies wetlands on the basis of ecological systems, vegetation and hydrology into the following hierarchical levels:

System
Subsystem
Class
Subclass
Hydrological regime

Figure 1 shows the hierarchy for the System, Subsystem and Class levels of the classification methodology. Table 2 summarizes the wetlands by size, soils, watershed and classification code. The following describes general characteristics of each hierarchical level.

Wetland Systems

Although there are Palustrine, Riverine and Lacustrine Systems within Bow, only Palustrine wetlands were inventoried as part of this study. This system is represented by the first capital letter in the code (ie. the P in PF01E).

Palustrine wetlands include all nontidal wetlands dominated by trees, shrubs, persistent emergents and emergent mosses or lichens. It also includes wetlands lacking such vegetation, but with all of the following four characteristics

FIGURE 1

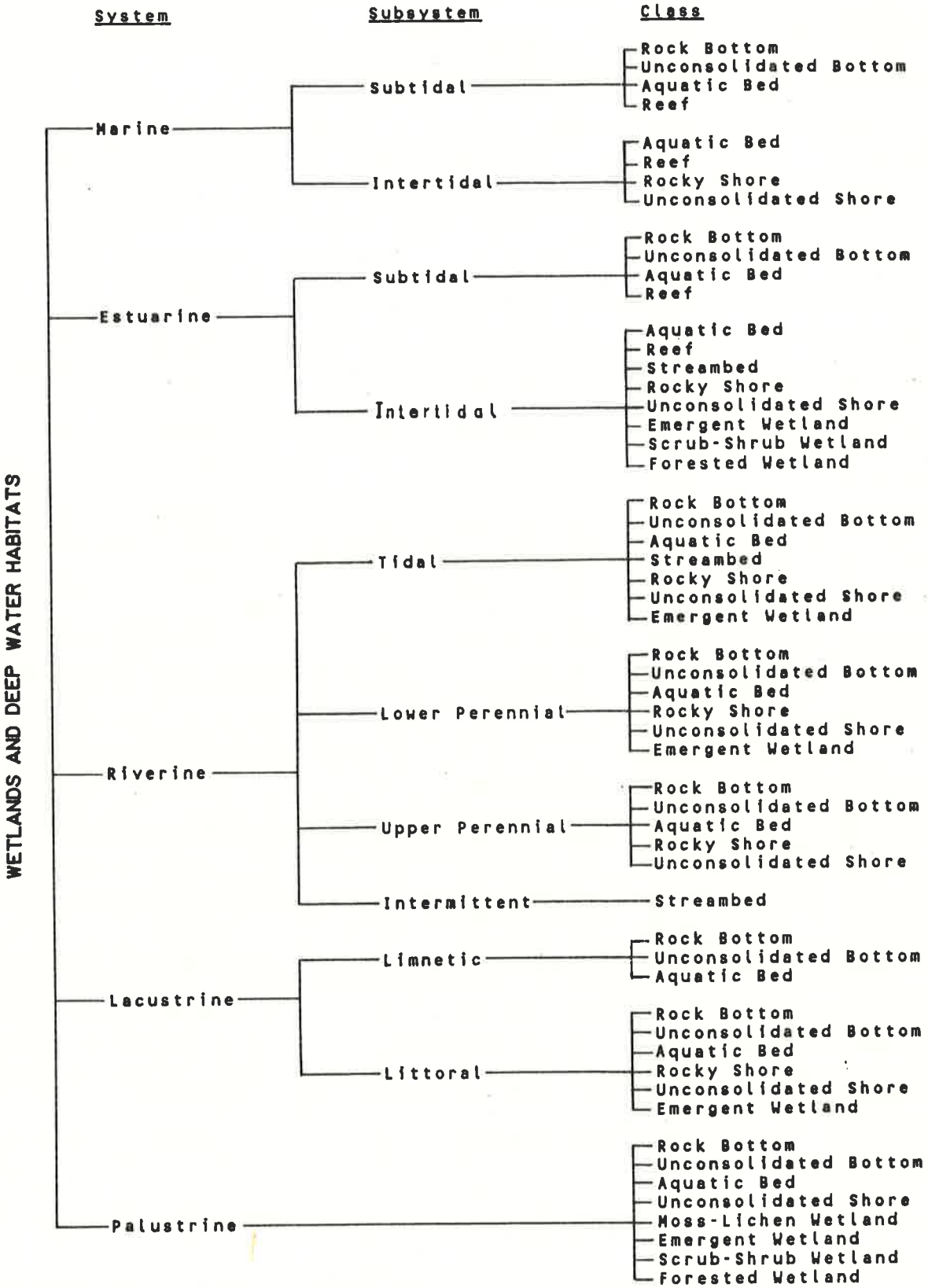

Fig. 1 Classification hierarchy of wetlands and deepwater habitats, showing Systems, Subsystems, and Classes. The Palustrine System does not include deep-water habitats.

TABLE 2
WETLAND CHARACTERISTICS

WETLAND NUMBER	CLASSIFICATION CODE	ACRES	AERIAL PHOTO NUMBERS	SOIL TYPE	SOIL DRAINAGE
1	filled	0	-	-	-
2	PEM2H	38	EVK 10,11	RdA	very poorly & poorly
3	PFO1E	8	EVK 10,11	Mp	very poorly
4	PAB2H	8	EVK 11, 780	Mp	very poorly
5	PFO1E	3	EVK 10,11	RdA	very poorly & poorly
6	PAB4H	11	EVK 10,11	Mh	very poorly
7	PFO1A	9	EVK 10, 11	RdB	poorly & very poorly
8	PFO1F	2	EVK 11, 780	Mp	very poorly
9	PFO1C	21	EVK 11, 780	RdA	poorly & very poorly
10	PEM5C	2	EVK 11, 780	RdA	poorly & very poorly
11	PFO1C	11	EVK 779,780	RdA	very poorly & poorly
12	PFO1/EM1F	8	EVK 779,11	RdA,Mp,RbB	poorly & very poorly
13	PFO1C	18	EVK 13, 781	RdA,Mp,RbB	poorly & very poorly
14	PFO1C	18	EVK 781,782	RdB	poorly & very poorly
15	PFO1E	28	EVK 781,782	RdA,Mp	very poorly
16	PFO1F	16	EVK 781,782	Mp	very poorly
17	PFO1/SS1E	10	EVK 780,781	Mp	very poorly
18	PFO1E	21	EVK 712,713	Mp	very poorly
19	PEM1Hb	45	EVK 712, 713	Mp,RdA	very poorly
20	PFO1/4C	17	EVK 712, 713	RdA,RbA,Mp	poorly & very poorly
21	PFO1A	2	EVK 711, 712	RdA	very poorly & poorly
22	PEM1/SS1G	2	EVK 712, 713	Mh	very poorly
23	PFO1/4A	5	EVK 712, 713	RdA	poorly & very poorly
24	PFO1C	28	EVK 641, 642	RdA	poorly & very poorly
25	PFO1E	2	EVK 641, 642	Mp	very poorly
26	PFO5/EM2Hb	51	EVK 640, 641	Mp	very poorly
27	PEM2E	3	EVK 640, 641	RdA	very poorly & poorly

TABLE 2
(CONTINUED)

WETLAND NUMBER	CLASSIFICATION CODE	ACRES	AERIAL PHOTO NUMBERS	SOIL TYPE	SOIL DRAINAGE
28	PF01E	8	EVK 639,640	Mp	very poorly
29	PF01E	48	EVK 639,640,641	RdA	very poorly & poorly
30	PF01/4A	12	EVK 639,640	RdA	very poorly & poorly
31	PF01/4A	13	EVK 710, 711	RdA	poorly & very poorly
32	PSS1/AB2Hb	52	EVK 710, 711	Mp	very poorly
33	PEM1F	1	EVK 710, 711	Mp	very poorly
34	PEM1F	28	EVK 710, 711	Mp,RbB	very poorly
35	PEM1/F01E	110	EVK 709, 710	Mp,RdB,RdA	poorly & very poorly
36	PF04/1C	95	EVK 637,638	RdA,RdB,AgA	poorly & very poorly
37	PF01E	20	EVK 639, 640	RdA	poorly & very poorly
38	PF01E	26	EVK 638, 639	RdA	poorly & very poorly
39	PF01C	10	EVK 708, 709	RdB	poorly
40	PF01/EM1E	49	EVK 709, 710	RdA	poorly & very poorly
41	PF01/4E	11	EVK 709, 710	Sc	very poorly
42	PSS1/EM1F	12	EVK 709, 710	RdA	poorly & very poorly
43	PF01E/F05Hb	35	EVK 7, 10	Mp	very poorly
44	PF01/5EB	21	EVK 8, 9	RdA	poorly & very poorly
45	PSS1/F01E	103	EVK 8,9,10	Mp,RdA	very poorly & poorly
46	PEM1Eb	2	EVK 8, 9, 10	Mp	very poorly
47	PF01C	8	EVK 779, 780	RdB	poorly
48	PF01C	8	EVK 709, 710	RdA	very poorly
49	PF01C	7	EVK 709, 710	RdA	very poorly & poorly
50	PF01C	8	EVK 708, 709	RdA	very poorly & poorly
51	PF01E	10	EVK 708, 709	Mp	very poorly
52	PF01E	53	EVK 776, 777	Mp,RdB,RdA,Mp	very poorly
53	PF01A	3	EVK 7, 8	RdB	poorly

TABLE 2
(CONTINUED)

WETLAND NUMBER	CLASSIFICATION CODE	ACRES	AERIAL PHOTO NUMBERS	SOIL TYPE	SOIL DRAINAGE
54	PF01E	5	EVK 7,8	RdA	poorly very poorly
55	PSS1/F01E	149	EVK 1009	RbA,AgA,RdA,Mp	poorly & very poorly
56	PSS3B	410	EVK 5,6,7	Mp,RdA,RdB,AgA	very poorly & poorly
57	PSS1F	11	EVK 1009	Mp,RdA	very poorly & poorly
58	PSS1F	79	EVK 1243,1244	Mp,AuB,Sc	poorly & very poorly
59	PSS1/F01E	143	EVK 1244,1245	Mp,RdA,RdB	very poorly & poorly
60	PF01E	7	EVK 1244,1245	RdA,Mp	very poorly & poorly
61	PF01C	3	EVK 1244,1245	RdB	poorly
62	PAB2Hb	7	EVK 1009,1010	Mp	very poorly
63	See 56 (combined)				
64	PF01A	69	EVK 774, 775	RdA	poorly & very poorly
65	PF01C	84	EVK 774, 775	RdA,RdB,Sa	poorly & very poorly
66	PF01E	14	EVK 774, 705	Lm,Aga,Ru,Sa	poorly & very poorly
67	PAB2/F01H	38	EVK 775, 776	Mp,RdB	very poorly & poorly
68	PF01C	11	EVK 774, 775	Sc	very poorly
69	PF01E	7	EVK 776, 777	RdA	poorly & very poorly
70	PF01C/E	59	EVK 706,707,708	RdA	very poorly & poorly
71	PF01C	7	EVK 706, 707	RdA	very poorly & poorly
72	PF01E	46	EVK 706, 707	RdB,Mp,RdA	poorly & very poorly
73	PEM2C	2	EVK 707, 708	RdB	poorly
74	PF01C	7	EVK 705, 706	RdA	poorly &
75	PF01C	4	EVK 705, 706	Ru	poorly
76	PF01C	14	EVK 635, 636	Ru	poorly
77	PSS1E	3	EVK 635, 636	Sa	very poorly very poorly

TABLE 2
(CONTINUED)

WETLAND NUMBER	CLASSIFICATION CODE	ACRES	AERIAL PHOTO NUMBERS	SOIL TYPE	SOIL DRAINAGE
78	PF01C	21	EVK 635, 636	RdB	poorly
79	filled	0	-	-	-
80	PF01C	31	EVK 636, 637	Ru,AgA	poorly
81	PSS1F	50	EVK 636, 637	Ru,Mp,Mn	poorly
82	PF01E	3	EVK 635, 636	Mnvery	poorly
83	filled	0	-	-	-
84	filled	0	-	-	-
85	POWZHx	3	EVK 567	AgA	poorly
86	PF01E	83	EVK 567	Mp,AgA,Ru	poorly & very poorly
87	filled	0	-	-	-
88	filled	0	-	-	-
89	POWZH	3	EVK 567	Open water	
90	PF01E	5	EVK 567	RdA	poorly & very poorly
91	POWZHx	7	EVK 568	Mp	very poorly
92	POWZHX	1	EVK 568	Mp	very poorly
93	PF01C	5	EVK 780, 781	No data	No data
94	PSS1E	4	EVK 712, 713	No data	No data
95	PF01C	19	EVK 712, 713	RdA,Mp	very poorly poorly
96	PF01E	3	EVK 710, 711	No data	No data
97	PF01E	4	EVK 567, 568	Mp	very poorly
98	PF01/EM1E	9	EVK 567, 568	Sc	very poorly
99	No Wetland due to mistake in numbering				
100	PF01E	2	EVK 776, 777	No data	No data
101	POWZHx	1	EVK 567, 568	No data	No data
102	PF01C	1	EVK 7, 10	No data	No data
103	PF01E	2	EVK 709, 710	No data	No data
104	POWZHx	1	EVK 568	No data	No data

1) area less than 20 acres; 2) active wave-formed or bedrock shoreline features lacking; 3) water depth in the deepest part of the basin less than 2m at low water; 4) salinity due to ocean-derived salts less than 0.5 percent.

Palustrine wetlands include vegetated wetlands traditionally called marsh, swamp, bog, fen or prairie. They also include small, shallow permanent or intermittent water bodies often called ponds. Palustrine wetlands may be situated shoreward of lakes or river channels; on river flood plains; in isolated catchments or on slopes. They may also occur as islands in lakes or rivers.

Within the Palustrine System there is no Subsystem and there are eight possible Classes. Five of these Classes - Forested, Scrub-Shrub, Emergent, Aquatic Bed and Open Water were used to describe the wetlands within the study area. A sixth class is composed of various mixtures of the five other Classes and is labeled as "Mixed Classes".

Wetland Classes

On vegetated wetlands, a Class level code is assigned to the uppermost layer of vegetation that covers 30 percent or more of the substrate. The Class is represented by the second and third capital letters in the code (ie. the FO in PF01E). Table 3 shows the wetland acreages in Bow by dominant vegetative class. General characteristics of each class are described below:

A Forested wetland is characterized by woody vegetation that is 6m tall or taller. Normally, Forested wetlands possess an overstory of trees and an understory of shrubs. In the Northeast, Forested wetlands lack standing water

for most of the year, but like all wetlands, Forested wetlands are defined by the predominance of water. The red maple swamp is one of the most common Forested wetlands in Bow, as well as in New Hampshire. Though the red maple predominates in Forested wetlands, tupelo, black and white ash, yellow and gray birch, swamp white oak and American elm are also found here. Skunk cabbage, the first herb to grow in spring is usually found in the understory of the red maple swamp as is cinnamon fern. Highbush blueberry, common winterberry, and spicebush are common shrubs in the Forested wetlands.

Thirty-seven percent (940 acres) of the wetland acreage in this study was classified as Forested. (This percentage does not include classification codes where more than one Class was assigned: ie. PFO1/EM1E).

Scrub-Shrub wetlands include areas dominated by woody vegetation less than 6m (20 feet) tall. The species present include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. Scrub-Shrub wetlands may either represent a successional stage leading to Forested wetlands, or they may be relatively stable communities. Typical species that dominate Scrub-Shrub wetlands are alders (Alnus spp.), willows (Salix spp.), buttonbush (Cephalanthus occidentalis), red-osier dogwood (Cornus stolonifera) and young trees of species such as red maple, gray birch, hemlock and black spruce. Twenty-two percent (557 acres) of the wetland acreage in this inventory was classified as Scrub-Shrub.

The Emergent Class is characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. Persistent Emergent Wetlands are dominated by cattails (Typha spp.), bulrushes (Scirpus spp.), sedges (Carex spp.), loosestrife (Lythrum spp.), etc. Persistent Emergent Wetlands were classified on 121 acres or 4.7 percent of the wetland acreage in this study.

Non-persistent Emergent Wetlands are dominated by plants which fall to the surface of the substrate or below the surface of the water at the end of the growing season so that at certain seasons of the year, there is no obvious sign of emergent vegetation. Arrow arum, arrowhead and pickerelweed are examples of Non-persistent Emergents. Although Non-persistent Emergent communities are present in Bow's wetlands, they were not dominant at the Class level for any of the wetlands surveyed. Thus, none were classified as Non-persistent Emergent wetlands.

TABLE 3

WETLAND ACREAGE BY WETLAND CLASS

WETLAND CLASS	NUMBER OF AREAS	ACREAGE
Forested (FO)	53	940
Scrub-Shrub (SS)	6	557
Emergent (EM)	8	121
Aquatic Bed (AB)	3	26
Open Water (OW)	6	17
Mixed Classes (ie.FO/EM)	20	910
		2571

The Class Aquatic Bed includes wetlands and deepwater habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season in most

years. Aquatic Bed represents a diverse group of plant communities that require surface water for optimum growth and reproduction. They are best developed in relatively permanent water or under conditions of repeated flooding. The plants are either attached to the substrate or float free in the water above the bottom or on the surface. The Aquatic Bed Class covers only 26 acres or approximately 1 percent of the wetland acreage in this study. The Algal and Aquatic Moss Subclasses of Aquatic Bed were not observed in Bow.

The Submergent Vascular Subclass often occurs in sheltered areas where there is little water movement. Typical species include pondweeds, horned pondweed (Zannichellia palustris), wild celery, and waterweed (Elodea). Some of the Submergent Vascular species are characterized by floating leaves. Typical dominants include water lilies (Nymphaea, Nuphar), floating-leaf pondweed (Potamogeton natans) and water shield (Brasenia shreberi). The Submergent Vascular Subclass covers 15 acres or 57.6 percent of the aquatic bed wetland acreage.

In the Floating Vascular Subclass the plants float freely either in the water or on its surface. Dominant plants that float on the surface include the duckweeds (Lemna, Spirodela) and water lettuce (Pistia stratiotes). Dominance types for beds floating below the surface include bladderworts (Utricularia), coontails (Ceratophyllum), and water meal (Wolffia). The Floating Vascular Subclass covers 11 acres or 42.3 percent of the aquatic bed wetland acreage.

Another Class, Open Water, was used in the classification of wetlands in this study. In all cases where the open water code was assigned, the wetlands exist as pockets of standing water in areas of excavated sands and gravel.

Six wetlands were classified as Open Water wetlands with little to no vegetation observed in these areas. These six wetlands comprise 17 acres or .6 percent of the wetland acreage in Bow.

The sixth and final Class used to describe the wetland vegetative characteristics in this study is a Mixed Class. The Mixed Class includes the following combinations:

PF01/4	154	(6)
PF01/5	21	(1)
PF0/EM	117	(4)
PFO/SS	10	(1)
PSS/FO	392	(3)
PSS/EM	12	(1)
PSS/AB	52	(1)
PEM/FO	110	(1)
PEM/SS	2	(1)
PAB/FO	38	(1)
	910	(20)

Twenty wetland areas were assigned a Mixed Class. Where a Mixed Class was assigned the first Class listed is the more dominant of the two Classes present. The total area of wetland assigned a Mixed Class code was 910 acres or 35.4 percent of the wetland acreage in this study.

Wetland Hydrology

The hydrological regime is represented by the last capital letter of the classification code (ie. the E in PF01E). Hydrological regimes used to classify wetlands in the Bow study are the following:

temporarily flooded (A) - those zones which are usually inundated or saturated for at least seven consecutive days early in the growing season, but by the end of the growing season the water table usually lies well below the soil surface. These areas are generally located on gentle slopes adjacent to wetter areas.

saturated (B) - those zones where the water table is at the soil surface for extended periods during the growing season in all years except years of extreme drought, but surface water is seldom present.

seasonally flooded (C) - those zones which are usually inundated or saturated for extended periods (more than two weeks) early in the growing season, but surface water is usually absent by the end of the growing season in most years. The water table then usually lies well below the soil surface.

seasonally flooded/saturated (E) - those zones which are usually inundated for extended periods (more than two weeks) early in the growing season and where the substrate remains saturated for the rest of the growing season;

semi-permanently flooded (F) - those zones which have surface water throughout the growing season in most years;

intermittently exposed (G) - those zones which have surface water present throughout the year, except in years of extreme drought.

permanently flooded (H) - those zones which have surface water present throughout the year in all years.

Table 4 summarizes acres of wetland by hydrological regime.

TABLE 4
WETLAND ACREAGE BY HYDROLOGICAL REGIME

Hydrological Regime Modifier	Number of Areas	Acres
A	7	113
B	1	410
C	26	461
E	37	1052
F	9	207
G	1	2
H	14	267
Mixed Regimes	1	59
	96	2571

Applications

Information collected in this Phase I of the study has been summarized in Tables 1-4 and was compiled from the Wetland Inventory and Classification Forms in Appendix A, Volume II. The wetlands are numbered 1-104, both on the field sheets and on the accompanying base map (Bow Wetland Study, 1989, at a scale of 1"=1000').

These data can be used by the Conservation Commission and/or the Planning Board to quickly locate a wetland on the study map, a tax map or an aerial photo, and readily determine key characteristics of that wetland. This information should help the Conservation Commission and/or the Planning Board to:

- identify outstanding or unique qualities of the wetland.
- determine the relationship of this wetland to other im portant resources in town.
- ascertain the relative importance of this wetland to other wetlands and wetland systems in Bow.

- write descriptive and informative letters to the State Wetlands Board.

III. EVALUATION OF WETLAND FUNCTIONS

Process:

Ultimately, the management of wetlands as a natural resource involves the evaluation of the resource benefits that each wetland provides to the town. Not all wetlands perform the same services. Some wetlands may be valuable to the town for their flood storage and nutrient retention values while others may be a unique scientific and educational resource.

While the point can be made that all wetlands are important for different reasons, effective management requires that the town identify those wetland services (functions) which it believes critical to the long term safety, health and general welfare of its residents.

Management and protection techniques vary depending on the functions that each wetland provides. These techniques can be tailored to wetland needs once the wetlands have been evaluated and critical resources identified.

Ideally, the wetland functions of all wetlands in a town should be evaluated. Realistically, few towns are able to allocate the funds necessary to conduct a detailed evaluation of functions for all of its wetlands. Thus, when it is necessary to limit the scope of the evaluation the town must determine in advance of the evaluation process, which wetlands might provide critical services to the town.

As the Bow Conservation Commission desired to designate "Prime Wetlands" in the town, 8 wetlands were selected for evaluation with the provisions of RSA 483A:7 in mind.

The most restrictive provision of RSA 483A:7 is that a wetland, to qualify as "Prime" must have very poorly drained soils as identified in the SCS County Soil Survey. Of the 104 wetlands identified in Bow, 60 wetland areas contained very poorly drained soils (based on data in the Merrimack County Soil Survey).

The Town of Bow has been very active in studying and managing the town's natural resources. Many studies have been conducted in Bow that complement the work completed in this study.

The most pressing concern of the Conservation Commission was the assurance of a continued supply of quality groundwater for private and public drinking water supplies. A study recently completed by SEA Consultants (Aquifer Evaluation Investigation and Development of Groundwater Protection Program, 1987) was carefully reviewed prior to the selection of wetlands to be evaluated for possible designation as "Prime".

Other considerations that guided the Bow Conservation Commission in the selection of Bow's "Prime" wetlands were the following:

1. integrity of the wetland
2. extent and nature of development in the wetland's watershed
3. unique qualities of the wetland
4. protection of significant wetland/water resource systems
5. protection of tracts important for wildlife management
6. recognition of valuable resource areas as determined in public opinion surveys for Bow Master Plan and the Bow Recreation Plan.
7. consolidation of protection for wetlands on/or adjacent to town owned parcels of land.

After due consideration of groundwater concerns and the other issues listed above, the Bow Conservation Commission narrowed the list of 60 wetlands to fourteen strong candidates for further evaluation and possible designation as "Prime":

Wetland No.	Description
2	Putney Meadow Pond and surrounding wetlands
19	S.Bow Road and S. Bow Dunbarton Road
26	Hornbeam Swamp - Woodhill Hooksett Road
32	Great Meadows Swamp-Woodhill Hooksett Road
33	Small muck and peat area in Center Brook watershed
34	Wetland along Horse Brook, upstream of Bow Bog Road
35	Wetland along Bow Bog Brook, downstream of Bow Bog Road
40	Wetland along Bow Bog Brook and its tributaries, upstream of Stoneybrook Road
41	Wetland in headwaters of Center Brook - W. Branch Londonderry Turnpike
43	Headwaters of White Brook
44	Along White Brook - W. Branch Londonderry Turnpike
45	Just below headwaters of White Brook
55	Between Birchdale Road and Hooksett Turnpike
56	Turee Pond and surrounding wetlands
67	Town pond and skating rink; and contiguous wetlands
80	Dunklee Road
81	PSNH - Merrimack River

Although the Conservation Commission strongly desired to designate all of the above listed wetlands as "Prime", they were unable to, due to funding constraints.

Nevertheless, members of the Conservation Commission felt that all of these wetlands are important natural resources to the Town of Bow, and that these wetlands, and wetlands upstream or in the watershed of these wetlands should be protected from development.

The Bow Conservation Commission agreed on a total of 8 wetlands for evaluation and possible designation as "Prime". Five wetlands were selected at the Bow Conservation Commission meeting on July 17, 1989. An additional three wetlands were selected at the Bow Conservation Commission meeting on September 18, 1989. These eight wetlands are listed in Table 5 along with a discussion of the rationale for their selection.

Table 5

Final List of Prime Wetland Candidates

Wetland No.	Watershed	Rationale for Selection
32	Bow Bog Brook	Headwaters of watershed, secondary recharge area for Center Brook aquifer exploration area #3, pristine area, important to rest of watershed.
34	Bow Bog Brook	Primary recharge area for Center Brook aquifer exploration area #3, important wetland in the Bow Bog Brook system.
35	Bow Bog Brook	Primary recharge area for South Branch of the Bow Bog Brook aquifer exploration area #5, abuts Bow Tree Farm, wildlife management plan has been prepared for this area, is within large expanse of pristine area of which a large percentage is owned by the Town.

43	White Brook/ Turkey River	Headwaters of White Rock Brook watershed, headwaters of the larger Turkey River watershed, secondary recharge area for White Rock Brook aquifer exploration area #4, important to integrity and quality of downstream wetlands in this system; pristine.
45	White Brook/ Turkey River	Headwaters of White Rock Brook watershed; headwaters of the larger Turkey River watershed, secondary recharge area for White Rock Brook aquifer exploration area #4, important to integrity of downstream wetlands in this system, partly located on town owned land, a wide diversity of vegetation.
55	Turkey River	Primary and secondary recharge area for White Brook aquifer exploration area #4, abuts wetlands surrounding Turee Pond and is important to the protection of Turee Pond and environs.
56	Turkey River	Large bog-unique vegetation for Bow and in New Hampshire, much of this wetland is owned by Town of Bow, abutting wetlands in Concord are part of the Turkey River Trust for which there is a management plan and extensive trail system, important waterfowl nesting area, important recreational area for the Town of Bow.

Each of these eight wetlands were subsequently evaluated to identify values and characteristics in addition to those listed above.

Wetland 44 missing from table 5 (which only lists 7 of the 8 prime wetlands)

See table (which includes wetland 44

Methodology

Wetland functions were evaluated using the procedures outlined in the "Wetland Evaluation Technique" (WET), Version 2.0. The current version of WET is a product of the Wetlands Research Program of the Environmental Laboratory, U.S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi.

The objective of WET is to provide an evaluation technique that:

1. assesses most of the recognized wetland functions and values,
2. is applicable to a wide variety of wetland types,
3. is reproducible and
4. has a sound basis in the scientific literature.

In the Town of Bow Wetland Study, the following wetland functions were assessed using the WET technique:

- groundwater recharge
- groundwater discharge
- floodflow alteration
- sediment stabilization
- sediment/toxicant retention
- nutrient removal/transformation
- production export
- wildlife diversity/abundance
- aquatic diversity/abundance

WET can be used to evaluate wetland functions in terms of social significance, effectiveness and/or opportunity. The wetlands in this study were evaluated using all three portions of the WET methodology. Habitat suitability models were also com-

pleted for water dependent species believed to inhabit the "Prime" wetland candidates.

The social significance portion of the methodology assesses the value of a wetland to society due to its special designation, potential economic value and strategic location. The effectiveness portion of the methodology assesses the capability of a wetland to perform a function due to its physical, chemical or biological characteristics. The opportunity portion of the methodology assess the opportunity of a wetland to perform a function to its level of capability.

A total of 50 predictor questions were answered about each wetland to derive Level 2 effectiveness and opportunity ratings. The predictor questions for the Level 2 assessment require field and office data collection. The WET model interprets the data and assigns ratings of high, moderate or low to each function for each wetland evaluated.

Table 6 summarizes the effectiveness ratings assigned for each of the 8 wetlands evaluated.

Wetland Characteristics For High Effectiveness

The following paragraphs describe, in general, the wetland characteristics that are required in the model to assign a "High" effectiveness rating for each function. Wetland-specific characteristics for each of the eight wetlands can be found on the data forms in Appendix B, Volume II.

TABLE 6

BOW PRIME WETLANDS: EFFECTIVENESS RATINGS

Wetland	Size	Soil Type	Classification Code	GWR	GWD	FA	SS	STR	NRT	PE	WDAB	WDAM	WDAW	ADA
32	52	Mp	PSS1/AB2Hb	L	M	M	M	H	H	M	H	H	H	M
34	28	Mp	PEM1E	U	M	H	H	H	L	M	H	H	H	H
35	110	Mp,RdA	PEM1/FO1E	U	M	H	L	L	L	M	L	L	L	H
43	35	Mp	PF01E/F05Hb	U	L	H	L	H	M	M	H	L	L	M
44	21	RdA	PF01/5Eb	U	M	H	M	H	L	M	H	L	H	H
45	103	Mp,RdA	PSS1/F01E	L	M	H	H	H	L	M	L	L	H	L
55	149	Mp,RdA	PSS1/F01E	U	M	H	M	H	H	H	M	H	H	H
56	410	Mp,RdA	PSS3B	U	M	H	M	H	H	H	M	H	H	L

H = High M = Moderate L = Low U = Uncertain

Key to Abbreviations:

GWR - Groundwater Recharge
GWD - Groundwater Discharge
FA - Floodflow Alteration
SS - Sediment Stablization
S/TR - Sediment/Toxicant Retention
NR/T - Nutrient Removal/Transformation
PE - Production Export

WDAB - Wildlife Diversity/Abundance - Breeding
WDAM - Wildlife Diversity/Abundance - Migration
WDAW - Wildlife Diversity/Abundance - Wintering
AD/A - Aquatic Diversity/Abundance

Groundwater Recharge

There are three general sets of conditions which indicate a wetland has a high probability of recharging groundwater on a net annual basis. The first set of conditions consists of direct evidence of recharge through the use of groundwater wells or piezometer.

A second set of conditions exists for wetlands in a precipitation deficit region. The third set of conditions are for wetlands not in precipitation deficit regions. These wetlands must have a negative discharge differential and water quality anomalies or have a permanent inlet but no permanent outlet and be a fringe or island wetland. In addition, the wetland must have one of the following conditions: not be permanently flooded, have favorable topography, have an impervious watershed, have soils of slow infiltration, located upslope of a dam, have fine mineral soils or be in a karst region, and/or have expansive flooding or unstable flows.

Most of the eight wetlands received a rating of "uncertain" which means that additional data such as the SEA study and other site specific studies are needed to determine the improtance of these wetlands to groundwater recharge. The SEA study indicates that some of these wetlands are in key primary and/or secondary recharge areas. Consequently, the results of the SEA study were weighed more heavily than the results of the WET technique in developing the conclusion that the eight wetland areas selected for "Prime" do play a significant role in groundwater quality.

Groundwater Discharge

There are many sets of conditions under which wetlands will have a high probability of discharging groundwater on a net an-

nual basis. These include most permanently flooded or saturated wetlands that are: (a) in precipitation deficit regions, (b) immediately below dams, (c) larger than 200 acres, with a watershed less than 5 times the area of the assessment area, (d) larger than 200 acres and not surrounded by paved land, (e) steeper gradient downstream of the outlet than upstream of the inlet, (f) lacking inlets but having outlets, and not dominated by snowmelt (nonfringe wetlands only), (g) stable with regard to seasonal water-level fluctuations, or (h) characterized by springs, water quality, or temperature anomalies that suggest discharge. If the wetland is not permanently flooded or saturated, a rating of HIGH may still be assigned if at least two of the above are met.

None of the eight "Prime" wetland candidates received a "High" effectiveness rating for groundwater discharge. All except one, received a "Moderate" effectiveness rating for groundwater discharge.

Floodflow Alteration

There are five types of wetlands that most clearly are effective for altering floodflows. These include wetlands which: (a) have regulated outflows (reservoirs, dams), (b) have outflows that are measured as being less than inflows, (c) have neither an outlet nor an inlet, (d) expand their surface area by at least 25 percent for 20 days of the year and are larger than 5 acres, or (e) are larger than 200 acres and are either in a precipitation deficit region or (if flowing water is present) are at least 70% covered with dense woody vegetation. Additionally, they must not be tidal. Thus, the simple presence of vegetation which adds to channel roughness is considered insufficient to result in a rating of HIGH: the wet depression must remove (through evapotranspiration) or store water as well as create a lag (desynchronized) effect.

Seven of the eight "Prime" wetland candidates received a "High" effectiveness rating for floodflow alteration. Only Wetland 32 did not.

Sediment Stabilization

Wetlands rated "High" for this function must be characterized by one of the following characteristics: potential erosive forces present; unsheltered, or Zone C greater than Zones A and B; ditches, canals, or levees are present that confine water; high water velocity; evidence of long-term erosion; or a water table influenced by an upstream impoundment. In addition, one of the following characteristics must also be present: rubble substrate, protection of nearby shorelines, greater than 20 feet width of erect vegetation, presence of forest or scrub-shrub, or good water and vegetation interspersion.

One two of the wetlands, Wetland 34 and Wetland 45 received a "High" effectiveness rating for sediment stabilization.

Sediment/Toxicant Retention

Wetlands considered by the method to have high effectiveness for sediment trapping include ones with no outlets; ones that are impounded (though it can be argued that the dam, not the wetland, is the factor reducing sedimentation); ones where water sampling (especially during storms) directly indicates that outlet waters have less inorganic particulate matter than nontidal inlet waters; ones that are vegetated with erect, persistent vegetation and comprise all of a clearly defined delta, island, bar, or peninsula; ones where there is direct evidence of accretion from historic photographic evidence or field sampling; or ones in basically depositional environments with erect vegetation wider than 20 feet.

Other wetlands qualifying for a rating of "High" are those having most of the following conditions: constricted outlet; no flow or slow-velocity flow; riverine with good pool-riffle ratio (if cobble-gravel sediment) or adequate pools and instream debris; short fetch; great depth (or shallower depths with shorter fetches); and relatively long duration and extent of seasonal flooding. In addition, such wetlands also must be free of artificial channelization and soil tillage, as well as having erect vegetation in a zone at least 20 feet wide.

Seven of the eight "Prime" wetland candidates received a "High" effectiveness rating for sediment/toxicant retention. Only Wetland 35 received a "Low" rating for this function.

Nutrient Removal/Transformation

Sediment retention is often (but not always) accompanied by nutrient retention; nutrient retention is often (but not always) accompanied by sediment retention. In using the WET technique conditions conducive to sediment trapping such as the presence of inlets with constricted or no outlets, indicate a high probability for nutrient removal/transformation. Alternatively, the presence of most of the following conditions also indicates a high probability of nutrient removal/transformation: low water velocity or presence of significant vegetation; fine mineral soils and alkalinity greater than 20 mg/1; high plant diversity with no dead forested or scrub-shrub areas or structures to confine water, significant vegetation and nutrient sources, and hydroperiod permanently flooded or saturated.

Because of the similarity to the characteristics for sediment/toxicant retention, the same 7 "Prime" wetland candidates received a "High" effectiveness rating for nutrient removal/transformation.

Production Export

To attain a rating of "High", the wetland must have conditions favoring primary productivity (relative to similar wetland types within the same region) of wetland plants, as well as having a permanent outlet. If the wetland System is Riverine the following conditions must be present: potentially eutrophic conditions, watershed greater than 100 square miles, significant areas of erect or submerged vegetation. If the wetland System is Palustrine the following conditions must be present: significant areas of erect vegetation; potential erosive conditions, Zone B greater than 10% of wetland; potential for expansive flooding; potential for eutrophic conditions or high levels of dissolved solids; high plant productivity; and fringe or island situation. In addition, for all wetland Systems, one of the following conditions must not be present: moss-lichen Class is extensive; sandy substrate; water velocity high or wetland unsheltered; low water/vegetation interspersion; presence of direct alteration; artificially manipulated water levels; small watershed; or low levels of suspended solids.

None of the eight "Prime" wetland candidates received a "High" effectiveness rating for production export. All eight wetlands received a rating of "Moderate".

Wildlife Diversity/Abundance for Breeding

For purposes of this method, a "High" rating for a wetland means that during the breeding season the wetland normally supports a notably great on-site diversity and/or abundance of wetland-dependent birds. This definition does not take into account the contribution of the wetland to off-site (regional) faunal richness or the uniqueness/rarity of the species.

There are six types of wetlands that have a high probability of supporting an exceptional diversity of breeding birds. Certain individual wetlands within the following types may be rated HIGH:

1. Non-wooded prairie potholes.
2. Western riparian zones.
3. Bottomland hardwoods.
4. Other floodplain wetlands.
5. Large and vegetationally diverse wetlands.
6. Moderate-size wetlands that are oases or complexes and have at least minimal interspersion.

Accuracy in the use of this key depends on reliable estimation of the following characteristics: surrounding land use, potential sources of toxic material, location in a precipitation deficit area, interspersion, size, and vegetation class.

Wetlands 32, 34, 43, 44, 55 and 56 received a "High" rating for wildlife diversity/abundance. Only Wetlands 35 and 45 received "Low" ratings for this function.

Wildlife Diversity/Abundance for Migration and Wintering

For purposes of this method, a "High" rating for a wetland means that during migration or winter, the wetland normally supports a notably great on-site diversity and/or abundance of wetland-dependent birds.

This key recognizes three general types of wetlands which, in a national context, have a High probability of supporting an exceptional diversity of wildlife during migration. Certain individual wetlands within the following types may be rated High:

1. West coast freshwater wetlands located within 5 miles of Estuarine wetlands larger than 5 acres (or vice versa).
2. Moderate or large-sized mudflats with good visibility and adjoined by emergent marsh.
3. Wetlands with good vegetational diversity and interspersion, generally large and in agricultural areas or along river valleys or coastlines.

Wetlands potentially rated "High" for wintering wildlife include 1 and 2 above and also 3 above if the wetland is unfrozen. Wetlands 32, 34, 55 and 56 received a "High" effectiveness rating for migration of wetland dependent birds. Wetlands 32, 34, 44, 45, 55 and 56 received a "High" effectiveness rating for wintering of wetland dependent birds.

Aquatic Diversity/Abundance

If the wetland does not meet the conditions necessary to receive a "Low" probability rating, a majority (not all) of several conditions must be present for a "High" probability rating to be achieved.

The wetland: (a) should have an inlet and outlet; (b) should be larger than 200 acres or, if smaller and in an ice-hazard region, should have a large watershed; (c) should not be dominated by sand bottom; (d) should be permanently flooded (at least in part); (e) should have a shallow area with diverse cover and vegetation that covers at least 10% of the area of the deepwater; (f) should have a diversity of depth categories and adequate dissolved oxygen; (g) should not be leveled or ditched; (h) should expand substantially with natural seasonal flooding; and (i) should not be oligotrophic or should have suitable values for the morphedaphic index.

If Palustrine, in addition to characteristics in the above paragraph, the wetland: (a) should have moderate amounts of erect vegetation well juxtaposed with open water; (b) if forested, should have some flow present throughout; and (c) should not have its water levels subject to artificial manipulation (except for intentional ecological management).

Four of the "Prime" wetland candidates; 34, 35, 44, and 55 received a "High" effectiveness rating for aquatic diversity/ abundance.

Prime Wetland Candidates

The following pages highlight outstanding and/or unique characteristics of each of the eight "Prime" wetland candidates.

Wetland 32

This 52 acre wetland is located in the headwaters of Horse Brook which eventually flows into Bow Bog Brook east of Bow Bog Road. The watershed of this wetland is mostly undeveloped. Adjacent slopes average 15-25 percent and are forested. Hemlock, white pine and beech are common species on these slopes.

There are at least three (3) intermittent inlets to this wetland. No perennial inlets flow into Wetland 32. There is only one outlet which is dammed by two consecutive beaver dams. Below the lowest beaver dam, the stream channel averages 10 to 15 feet wide and ranges in depth from 6 inches to one foot. The stream channel is lined with boulders, cobbles and pebbles, and both slow moving backwater pools interspersed with riffle areas are present.

Surface runoff, via this perennial channel flows into the primary recharge zone for the Center Brook aquifer exploration area. Thus, Wetland 32, is in the secondary recharge area for one of the most promising aquifers in Bow. Water quality in Wetland 32 and its perennial outlet will have a direct impact on surface and ground water quality downslope. For this reason, protection and maintenance of water quality in Wetland 32 is highly recommended.

Due to impoundment by beaver, the wetland is mostly permanently flooded except for small hummocks (islands) of shrubby vegetation. There are two dominant Classes of vegetation in this wetland. In the portion of the wetland closest to the outlet the standing water is deeper and aquatic bed vegetation is dominant. Submerged and floating vascular species such as milfoil, duckweed and calla lily are dominant here, as well as standing dead trees. (See Photo 1). To the south and closer to Woodhill-Hooksett Road, the vegetation changes to mostly shrubs such as leatherleaf and

PHOTO 1

Wetland 32. Great Meadow Swamp. Photo taken from beaver dam looking south and west. Vegetation in this wetter portion of the swamp is aquatic bed. Water lilies are dominant here.

PHOTO 2

Wetland 32. Great Meadow Swamp; January, 1990. Photo taken from Woodhill-Hooksett Road looking north. Leather-leaf shrub swamp and remains of standing dead trees are in the foreground.

sheep laurel, interspersed with grasses and sedges (See Photo 2). Wood duck houses are present through the wetland. One great blue heron was observed during the visit to this wetland.

Wetland 32 is important to the Town of Bow and should be designated a "Prime" wetland because it has the following important characteristics:

- in the headwaters of the Bow Bog Brook and Horse Brook watersheds.
- in the headwaters of the Bow Bog Brook and Horse Brook watersheds.
- in a pristine location.
- in the secondary recharge area for Center Brook aquifer exploration area.
- "HIGH" functional rating for sediment/toxicant retention.
- "HIGH" functional rating for nutrient removal/transformation.
- "HIGH functional rating for breeding of wetland dependent birds.
- "HIGH" functional rating for migration of wetland dependent birds.
- "HIGH" functional rating for wintering of wetland dependent birds.

A habitat suitability analysis was completed for 3 wetland dependent species believed to be using the wetland. The suitability ratings were assigned as shown below:

Wood Duck - breeding	HIGH
Wood Duck - migration	HIGH
Wood Duck - wintering	HIGH
Great Blue Heron	HIGH
Brook Trout	MODERATE

Wetland 34

Wetland 34 encompasses Horse Brook from a point about four hundred feet downstream of the outlet from Wetland 32. This 28 acre wetland lies along the southern edge of the primary exploration area for the Center Brook aquifer. Thus, Wetland 34 plays a very important role in the protection of the quality of surface and groundwater entering the primary recharge area.

Although its effectiveness at recharge was listed as uncertain, the location of this wetland is key in the protection of this portion of the watershed surrounding the Center Brook recharge area.

The watershed of this wetland is mostly undeveloped with the exception of a subdivision off Hope Road (approximately 500 upslope from the wetland). Slopes adjacent to the wetland range from 8 to 60 percent and hemlock is the dominant species on the slopes closest to Wetland 34.

Horse Brook is a perennial inlet and outlet to this wetland. Within the wetland the brook is extremely sinuous and fairly slow-moving. The channel averages five feet wide and is about one foot deep. Water levels in the wetland are dominated by the brook. The wetland is flooded frequently throughout the growing season and the very poorly drained muck and peat soils remain saturated for the rest of the year.

The dominant vegetative class in this wetland is the Persistent Emergent Class. Grasses and sedges are the dominant species throughout most of the wetland. Sheep laurel, meadowsweet, alder and woolgrass are scattered throughout the wetland in pockets. (See Photo 3). The ground is almost 100 percent covered by sphagnum moss and swamp dewberry. About 25 percent of the wetland

PHOTO 3

Wetland 34. Wetland along Horse Brook. Photo taken from the eastern boundary looking north toward the power line and Bow Bog Road. The persistent emergent vegetation is dominant in the foreground. Behind it, a band of meadowsweet, sheep laurel and other shrubs is visible.

has a sparse forest cover of red maple and standing dead with a few white pine scattered throughout.

Wetland 34 is important to the maintenance of surface and ground water quality in the Town of Bow and should be protected for the following reasons:

- is located in the primary and secondary recharge zone for the Center Brook aquifer exploration area.
- is in a pristine location.
- "HIGH" functional rating for floodwater alteration.
- "HIGH" functional rating for sediment stabilization.
- "HIGH function rating for sediment/toxicant retention.
- "HIGH" functional rating for breeding of wetland dependent birds.
- "HIGH" functional rating for migration of wetland dependent birds.
- "HIGH" functional rating for wintering of wetland dependent birds.
- "HIGH" functional rating for aquatic diversity/abundance.

A habitat suitability analysis was performed for 5 wetland dependent species believed to be using the wetland. The suitability ratings were assigned as shown below:

Black Duck - breeding	MODERATE
Black Duck - migration	MODERATE
Black Duck - wintering	LOW
Wood Duck - breeding	MODERATE
Wood Duck - migration	MODERATE
Wood Duck - wintering	LOW
Ring-Neck Duck - breeding	LOW
Ring-Neck Duck - migration	LOW
Ring-Neck Duck - wintering	LOW
Great Blue Heron	HIGH
Brook Trout	MODERATE

Wetland 35

Wetland 35 is a 110 acre wetland along Bow Bog Brook between Bow Bog Road and Highway I-93. Wetland 35 is a continuation of the wetland system of which Wetlands 32 and 34 are a part. A portion of Wetland 35 is located within the primary exploration area for the South Branch of the Bow Bog Brook aquifer. (SEA Report, Figure 5). The remainder of Wetland 35 is located in the secondary recharge zone of the same aquifer.

Soils on the abutting banks are mostly well to excessively well-drained Hinckley soils with slopes ranging from 8-60%.

There are at least seven (7) inlets to this wetland of which three (3) are perennial (Bow Bog Brook, Center Brook and Horse Brook), and four (4) are intermittent. Most of the wetland is flooded often throughout the growing season. The very poorly drained soils remain saturated when not flooded, for the rest of the year. Bow Bog Brook flows through the entire wetland, and is the only outlet from the wetland. Bow Bog Brook is approximately 15-20 feet wide, one-two feet deep and has a good ratio of pools to riffles. Two vegetative classes are dominant in this wetland. The Persistent Emergent Class is dominant in the area surrounding the confluence of all the wetland inlets. Cattails are the dominant species in this Class. (See Photo 4). Alder, red maple, gray birch, and yellow birch are scattered along the wetland edges.

Further downstream the wetland changes from an emergent wetland to a forested wetland ranging in width from 50 to 100 feet on either side of Bow Bog Brook. Dominant species in the forested portion of the wetland are red maple, yellow birch, elm, sphagnum moss, skunk cabbage, twisted stalk and sensitive fern.

PHOTO 4

Wetland 35. Photo taken from Dean Avenue looking east. The cattail marsh and standing dead vegetation are dominant here at the confluence of Bow Bog Brook with other unnamed streams.

A large number of acres in the immediate watershed of this wetland are owned by the Town and managed by the Bow Conservation Commission as part of a town forest. The Bow Conservation Commission has dedicated time and money to the careful management of lands abutting Bow Bog Brook for their multiple use values. These lands have value to the Town of Bow as forest land, as lands actively managed for wildlife, as fisheries and as protective cover to maintain surface and groundwater quality.

Wetland 35 is an important multiple use area in the Town of Bow and should be protected as a "Prime" wetland for the following reasons:

- is located in the primary and secondary recharge zone for the Bow Bog Brook upstream aquifer exploration area.
- acts as a buffer zone for a significant portion of Bow Bog Brook which is a tributary to the Merrimack River.
- portions are located within one of the Bow Town Forests.
- is part of an area actively managed for wildlife.
- most of the watershed is undeveloped.
- "HIGH" functional rating for floodflow alteration.
- "HIGH" functional rating for aquatic diversity/abundance.

A habitat suitability analysis was performed for 7 wetland dependent species believed to occur occur within the wetland. The suitability ratings were assigned as shown below:

Black Duck - breeding	High
Black Duck - migration	Low
Black Duck - wintering	Low
Hooded Merganser - breeding	Low
Hooded Merganser - migration	High
Hooded Merganser - wintering	High
Willow Flycatcher	High
Alder Flycatcher	High
Belted Kingfisher	Low
Great Blue Heron	Moderate
Brook Trout	Moderate

Wetland 43

Wetland 43 is located in an important position as it is in the headwaters of White Rock Brook watershed and the much larger Turkey River watersheds. It is in the secondary recharge zone of the subwatershed of this wetland is mostly undeveloped. Adjacent slopes are 15-25 percent and forested with a wide range of deciduous and coniferous trees. At the base of the slopes in depressions contiguous with the wetland, hemlock is the dominant tree species.

There are at least four intermittent channels which flow into this wetland. There is only one outlet, which has been dammed in at least two places by beaver. The channel is not well defined within the wetland but is a perennial channel once it leaves the wetland.

Although two vegetative Classes dominate this wetland; the Broad-leaved Deciduous Forest Class and Standing Dead Forest Class, there are four vegetative communities represented in this wetland. Each of the communities is located in a progressively wetter portion of the wetland. The forested portion of the wetland has a red maple overstory with an extremely dense understory of alder and highbush blueberry. As the depth of standing water increases the forested community gives way to a shrub community dominated by alder, highbush blueberry and sedges. (See Photo 5). The shrub community grades into an emergent wetland dominated by cattails and sedges. (See Photo 6). Finally, in the portion of the wetland nearest the beaver dam, there is not much vegetation. Rather, standing dead trees, open water and sparse aquatic bed vegetation are present.

PHOTO 5

Wetland 43. Photo taken from the northern boundary of the wetland looking south across the wetland. This photo shows the break from the predominant cattail marsh to aquatic bed and nonpersistent emergent vegetation at the end of the wetland close to the beaver dam.

PHOTO 6

Wetland 43. Photo taken from the northern side looking northeast toward a small island of white pine, surrounded mostly by non-persistent emergent vegetation.

Due to its position at the head of the two watersheds, Wetland 43 is an important resource in the Town of Bow and should be protected as a "Prime" wetland for the following reasons:

- is located in the secondary recharge zone for the White Rock Brook aquifer exploration area.
- is in the headwaters of the Turkey River watershed which is protected in the City of Concord, and is also in the headwaters of White Rock Brook which is a highly scenic stream in Bow.
- the watershed of the wetland is mostly undeveloped.
- "HIGH" functional rating for floodflow alteration.
- "HIGH" functional rating for sediment/toxicant retention.
- "HIGH" functional ratings for breeding of wetland dependent birds.

A habitat suitability analysis was performed for 7 wetland dependent species believed to occur in this wetland. The suitability ratings were assigned as shown below:

Black Duck - breeding	MODERATE
Black Duck - migration	LOW
Black Duck - wintering	LOW
Wood Duck - breeding	MODERATE
Wood Duck - migration	MODERATE
Wood Duck - wintering	LOW
Ring-Neck Duck - breeding	LOW
Ring-Neck Duck - migration	LOW
Ring-Neck Duck - wintering	LOW
Alder Flycatcher	HIGH
Bell's Vireo	LOW
Brook Trout	LOW
Swainson's Warbler	HIGH

Wetland 44

Wetland 44 is located just upstream of a very scenic portion of White Rock Brook. It is the wetland furthest downstream in a system of 3 wetlands all designated as potential "Prime" wetlands. All three of these wetlands are in the upper reaches of the White Rock Brook and Turkey River watersheds.

There are at least three inlets two of which are intermittent and one perennial. There is one outlet, White Rock Brook which was dammed a very long time ago by beaver. This 21 acre parcel is situated on both sides of the East Branch of Londonderry Turnpike. A good portion of this wetland is on property owned by the Town of Bow. The Bow Conservation Commission manages the forested areas abutting the upper reaches of this wetland. This wetland is mostly forested, but because it was dammed by beaver a long time ago, a lot of vegetation regrowth has occurred and a wide diversity of species are present. Red maple, hemlock and standing dead trees are dominant in this wetland. Other common species are grasses, sensitive fern, royal fern, cinnamon fern, elm, yellow birch, elderberry, and bedstraw. (See Photo 7.)

This wetland is important to the protection of the entire White Rock Brook system and should be designated a "Prime" wetland for the following reasons:

- is located in the secondary recharge zone of the White Rock Brook aquifer exploration area.
- is located in the headwaters of the Turkey River Watershed.
- is located in a key position to protect the integrity of the scenic White Rock Brook just downstream.
- is partly located on town owned property.
- the watershed is mostly undeveloped.

PHOTO 7

Wetland 44. Photo taken from the west branch of the Londonderry Turnpike looking north and east toward an area ponded long ago by beaver. Regrowth of vegetation in this area has been lush. A wide diversity of wetland species are present.

- "HIGH" functional rating for floodflow alteration.

- "HIGH" functional rating for sediment/toxicant retention.

- "HIGH" functional rating for breeding of wetland dependent birds.

- "HIGH" functional rating for wintering of wetland dependent birds.

- "HIGH" functional rating for aquatic diversity and abundance.

A habitat suitability analysis was performed for 5 wetland dependent species believed to occur in this wetland. The suitability ratings were assigned as shown below:

Wood Duck - breeding	LOW
Wood Duck - migration	LOW
Wood Duck - wintering	LOW
Brook Trout	MODERATE
Alder Flycatcher	HIGH
Yellowthroat	HIGH
Northern Waterthrush	LOW

Wetland 45

This 103 acre wetland is located high in the Turkey River and White Rock Brook watersheds. A primary aquifer recharge area surrounds the upper reaches of this wetland. Except for some development at Bow Center, the watershed of this wetland is fairly undeveloped. Soils adjacent to the wetland are mostly sandy and occur on relatively steep (15-25 percent) slopes. A gravel pit has exposed some of these erodible soils along one boundary of the wetland.

At lease four (4) inlets flow into this wetland. One of these is a perennial brook which originates in Wetland 43. Of the other three inlets, one is definitely perennial (flows under Woodhill-Hooksett Road) and the other two were not field checked. The one perennial outlet (White Rock Brook) flows into Wetland 44.

This area was classified as a Scrub-Shrub/Forested, Broad-leaved Deciduous, seasonally flooded/saturated wetland. There are pockets of open water, standing dead and emergent vegetation as the dominant forest and scrub-shrub overstory. (See Photo 8.)

The diversity of vegetation types, the position of this wetland at the head of the watershed and its location in an area of groundwater recharge make this an important resource to the Town of Bow. It should be protected as a "Prime" wetland for all of the following reasons:

- is located in the headwaters of the White Rock Brook and Turkey River watersheds.
- exhibits a wide diversity of vegetation types.
- is located in a significant deposit of sands and gravels conducive to recharge of groundwater.
- "HIGH" functional rating for floodflow alteration.

PHOTO 8

Wetland 45. Photo taken from the west branch of Londonderry Turnpike looking south and west toward this scrub-shrub wetland. A wide diversity of vegetation types are present in this wetland.

- "HIGH" functional rating for sediment stabilization.

- "HIGH" functional rating for sediment/toxicant retention.

- "HIGH" functional rating for wintering of wetland dependent birds.

A habitat suitability analysis was performed for 5 wetland dependent species believed to occur in this wetland. The suitability ratings were assigned as shown below:

Black Duck - breeding	MODERATE
Black Duck - migration	LOW
Black Duck - wintering	LOW
Wood Duck - breeding	MODERATE
Wood Duck - migration	LOW
Wood Duck - wintering	LOW
Hooded Merganser - breeding	LOW
Hooded Merganser - migration	MODERATE
Hooded Merganser - wintering	MODERATE
Brook Trout	MODERATE
Great Blue Heron	LOW

Wetland 55

This 149 acre wetland abuts Wetland 56. These two wetlands were once contiguous and are still hydrologically connected, although the significance of this hydrological connection has been greatly reduced by the construction of Birchdale Road. Birchdale Road completely disconnects these wetlands except for two large culverted crossings. White Rock Brook and Bela Brook are two major perennial inlets to this wetland. Bela Brook flows into White Rock Brook in Wetland 55. White Rock Brook is the only outlet to this wetland.

Adjacent soil types are predominantly the very sandy, very permeable Hinckley series. This wetland almost surrounds the potential aquifer exploration area, WE-9 (as depicted in Figure 5 of the SEA report). So, despite the existing and extensive development around this wetland, the continued integrity and protection of water quality in Wetland 55 is important to the long term protection of groundwater quality as well.

The majority of this wetland is vegetated with shrubs. There are a few forested areas as well as pockets of open water rimmed by emergent vegetation. Red maple and alder are the dominant species here. Tussock sedge, cinnamon fern, willow, gray birch and highbush blueberry are species that were observed here as well. (See Photo 9.)

The channels within the wetland are very meandering and slow moving. The flow is almost undetectable, even though the channel averages 15-20 feet wide and 1.5 to 2 feet deep, at the point where it crosses under Birchdale Road.

PHOTO 9

Wetland 55. Photo taken from Birchdale Road between Cob Road and Birch Tree Lane. The dominant shrub is alder, but gray birch, red maple and other species are present.

This wetland is an important water resource to the Town of Bow and should be protected as a "Prime' wetland for the following reasons:

- is located at the confluence of White Brook and Bela Brook.
- is adjacent to the very unique Turee Pond and environs.
- is located in the primary recharge area of the White Brook aquifer exploration area.
- there is a significant potential for passive outdoor recreation when considered as part of the Turee Pond system.
- "HIGH" functional rating for flood flow alteration.
- "HIGH" functional rating for sediment/toxicant retention.
- "HIGH" functional rating for nutrient removal/transformation.
- "HIGH" functional rating for migration of wetland dependent birds.
- "HIGH" functional rating for wintering of wetland dependent birds.

A habitat suitability analysis was performed for 15 wetland dependent species of wildlife. Most of these species have been reported to occur in the vicinity of Wetland 55 and Wetland 56. The habitat suitability ratings were assigned as shown below:

Black Duck - breeding	HIGH
Black Duck - migration	HIGH
Black Duck - wintering	HIGH
Wood Duck - breeding	HIGH
Wood Duck - migration	HIGH
Wood Duck - wintering	HIGH
Common Merganser - breeding	LOW
Common Merganser - migration	LOW
Common Merganser - wintering	LOW
Ring-Neck Duck - breeding	LOW
Ring-Neck Duck - migration	LOW
Ring-Neck Duck - wintering	LOW
Great Blue Heron	LOW

Chain Pickerel	MODERATE
Red Fin Pickerel	MODERATE
Yellow Perch	MODERATE
Horned Grebe	LOW
Alder Flycatcher	HIGH
Willow Flycatcher	HIGH
Palm Warbler	LOW
Northern Waterthrush	LOW
Yellowthroat	HIGH
Green Heron	LOW

Wetland 56

This 410 acre wetland area surrounds and includes Turee Pond, a highly unique natural bog and pond environment. Wetland 56 is within the upper one-third of the Turkey River watershed. Just downstream from Wetland 56 and into Concord, most of the extensive wetland system along the Turkey River is protected and managed by the Turkey River Trust. The City of Concord is very interested in working with the Town of Bow to ensure the continuous protection of the upper reaches of the Turkey River watershed.

These are seven (7) inlets to this wetland, at least three (3) of which are perennial; White Rock Brook, Bela Brook, and an unnamed brook which outlets from the town skating rink. There are two perennial outlets - White Rock Brook and Bela Brook. These outlets average 10-20 feet wide and are anywhere from one to two feet deep on the average. The slope of the wetland and the outlets is nearly level, so although there is a lot of water moving through the system, it is moving at a very slow rate.

One of the most unique aspects of Wetland 56 is the large, floating bog which surrounds a good portion of Turee Pond. Bogs are a rare wetland resource in New Hampshire and are considered an important resource statewide. The uniqueness of the area offers scientific and educational, as well as passive recreational opportunities (fishing, hunting, canoeing, photography, and hiking). (See Photo 10.)

PHOTO 10

Wetland 56. Photo taken from Surrey Coach Lane looking north and east toward Turee Pond and the surrounding spruce bog. Black spruce, tamarack and leatherleaf are some of the dominant species in the bog to the left of the pond.

There are at least 6 vegetative types within the wetland: open water, bog, emergent, aquatic bed, scrub-shrub and some broad-leaved deciduous forest. Most of the wetland is a bog with black spruce and tamarack dominant. Other bog species such as leatherleaf, sphagnum, pitcher plant and sundew, are also present in the bog. The diversity of vegetation types is excellent for some species of waterfowl and other wetland dependent wildlife.

A sand and gravel aquifer is located on town-owned land adjacent to Turee Pond, however water quality in this aquifer has been degraded by leachate from the town dump. Thus, this aquifer is not under consideration as a potential municipal water supply.

Wetland 56 is an important resource to the Town of Bow and should be protected as a "Prime" wetland for the following reasons:

- presence of a unique and rare vegetational plant community; a spruce-tamarack floating bog.
- is high in the Turkey River watershed and important to protection of the Turkey River Trust Management Area.
- there are significant opportunities for passive outdoor recreation.
- "HIGH" functional rating for flood flow alteration.
- "HIGH" functional rating for sediment/toxicant retention.
- "HIGH" functional rating for nutrient removal/transformation.
- "HIGH" functional rating for migration of wetland dependent birds.
- "HIGH" functional rating for wintering of wetland dependent birds.

A habitat suitability analysis was performed for 9 wetland dependent wildlife species. Most of these species have been ob-

served in Wetland 56 and nearby environs. The habitat suitability ratings were assigned as shown below:

Black Duck - breeding	LOW
Black Duck - migration	HIGH
Black Duck - wintering	HIGH
Wood Duck - breeding	HIGH
Wood Duck - migration	HIGH
Wood Duck - wintering	HIGH
Common Merganser - breeding	LOW
Common Merganser - migration	LOW
Common Merganser - wintering	LOW
Ring-Neck Duck - breeding	MODERATE
Ring-Neck Duck - migration	LOW
Ring-Neck Duck - wintering	LOW
Great Blue Heron	LOW
Chain Pickerel	HIGH
Red Fin Pickerel	HIGH
Yellow Perch	MODERATE
Horned Grebe	LOW

Other wildlife species reported in the area are: deer, porcupine, skunk, woodchuck, otter, squirrel, chipmunk, beaver, muskrat, red fox, marsh hawk, turkey vulture, kingfisher, turtles, frogs, and snakes.

RECOMMENDATIONS

The Town of Bow has gone a long way toward the protection of its significant natural resources through the aquifer study and the wetland inventory and designation of "Prime" wetlands. The results of the aquifer study were coordinated in great detail in the "Prime" wetland selection process. As a result, the wetlands selected for "Prime" wetland designation represent the culmination of several years of study and thought, about important natural resource systems in Bow. Although there are other important wetlands and natural resource areas in Bow, the areas selected for "Prime" wetland designation provide a multitude of services and benefits to Bow.

Much has been done to identify these resources, yet a key element remains to be done. In order to ensure the longevity of these valuable resources for perpetuity, it is not enough to rely on zoning alone. Zoning is a land management tool subject to interpretation by different personalities and land use pressures over time.

Rather, continous protection of these resources requires the development of an active management plan which includes components for protection such as: acquisition, conservation easements, deed restrictions, protective covenants, etc. An active management plan should also include mechanisms for public use and enjoyment of the area. All of the "Prime" wetland candidates are parts of "Systems" that offer great opportunities for passive outdoor recreation projects. Interpretative trails with educational stops, an accompanying brochure and trail guide could be managed by the Conservation Commission and would enhance public perception of the value of these resources.

Finally, a management plan could identify possibly areas adjacent to the "Prime" wetlands where wetlands restoration, enhancement and/or purchase could be accomplished as a means of mitigation for unavoidable wetland losses in other areas in the Town of Bow.

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