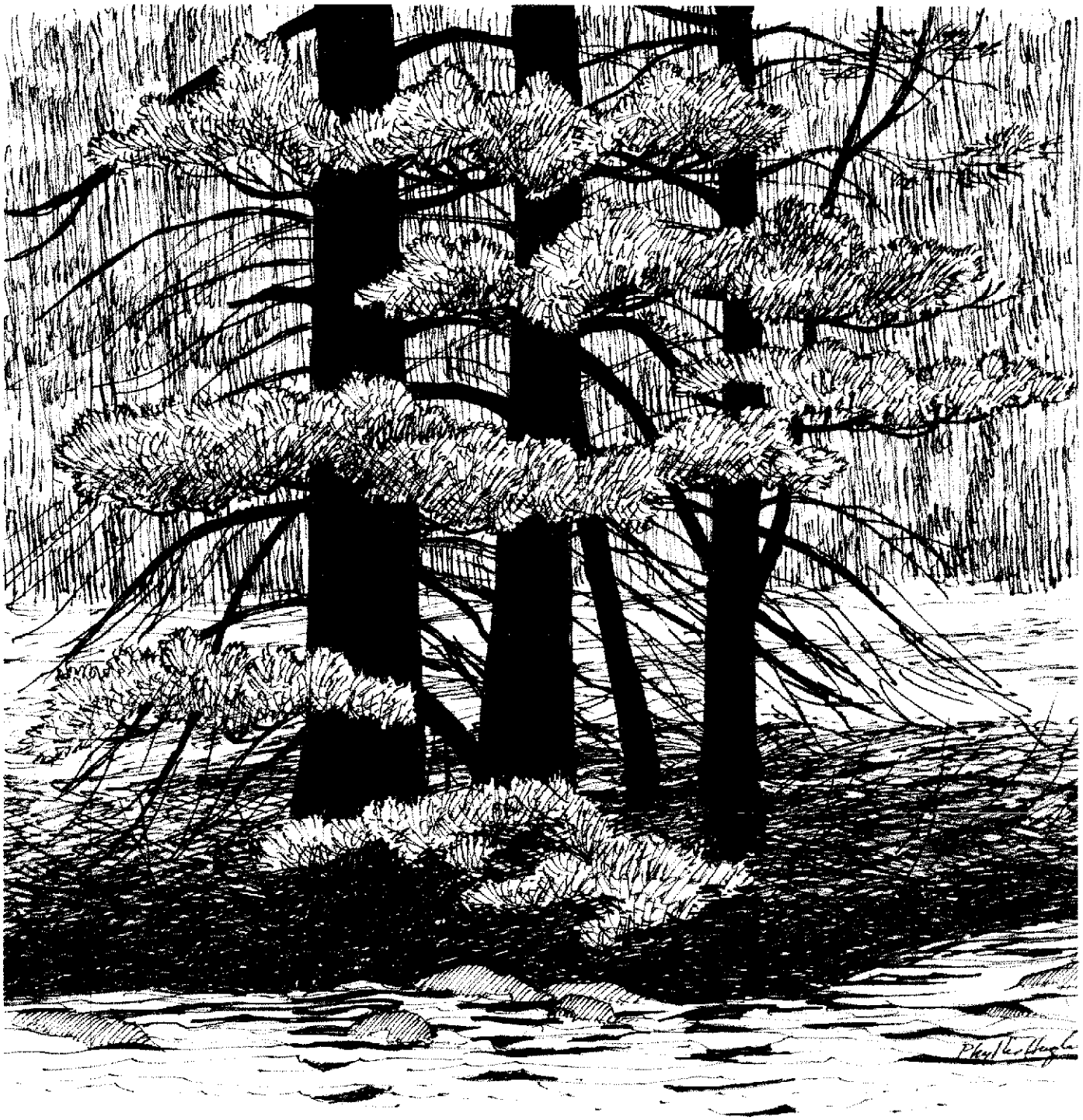
Section 11: References



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Section 12: Appendices

Appendix A: Land Protection Values

Appendix B: Conservation Commission Rules and Regulations

Appendix C: Carlisle Trail Maps

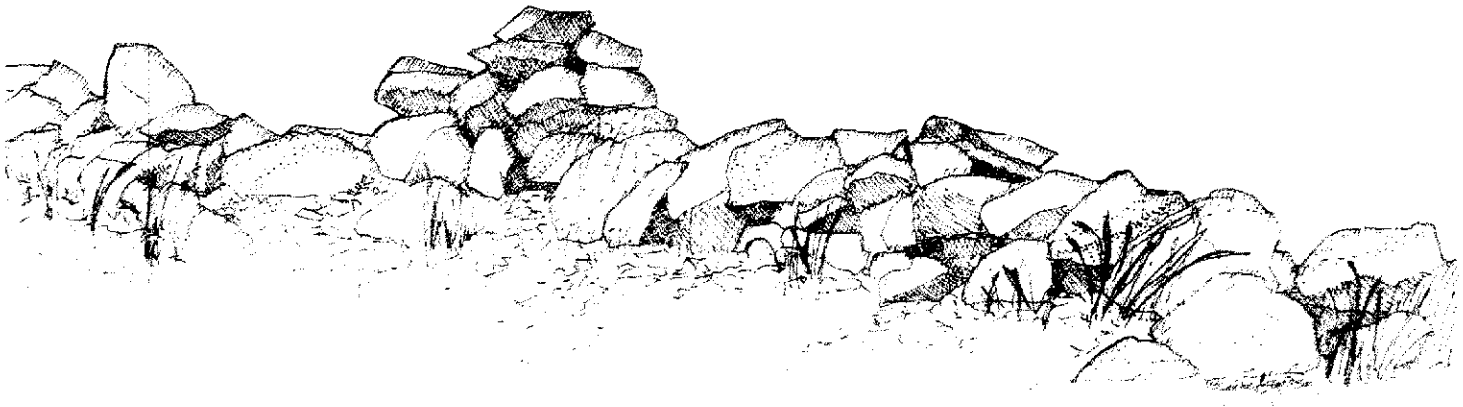
Appendix D: Natural Heritage and Endangered Species Program (NHESP) Fact Sheets: "Endangered" and "Special Concern" Species in Carlisle

Appendix E: Partial Wildlife Inventory for the Town of Carlisle, Massachusetts

Appendix F: Sample of Letter to Contiguous Towns

Appendix G: Self-Evaluation of Carlisle's Compliance with ADA Requirements

Appendix H: Recreation Commission Grievance Policy re: Equal Access



Appendix A

Land Protection Values

Appendix A: Land Protection Values

These values are used to rank unprotected parcels for their desirability for protection, if and when they become available. Parcels are desirable if they add to the rural character of the town, preserve wildlife habitat for flora or fauna, or provide ready access to active or passive recreation for people.

Size – Large parcels of land are more valuable than small parcels both for wildlife habitat and for open and passive recreation.

Parcels greater than or equal to 75 acres were scored 4;

parcels greater than or equal to 30 acres but less than 75 acres were scored 3;

parcels greater than or equal to 20 acres but less than 30 acres were scored 2;

parcels greater than or equal to 10 acres but less than 20 acres were scored 1.

Linking Location – The land abuts a parcel of land that is already protected (existing link) or a significant parcel of undeveloped land that is not yet protected but is desirable (potential link). Both existing and potential links increase the usefulness of the entire tract (consisting of the linking parcel and the abutted parcel) both for wildlife habitat and for open and passive recreation.

Balancing Location – The land is located in a section of town that does not have other open space nearby and, therefore, would help balance the distribution of open space around town.

Woodlands – The land contains an exceptional forest, a historically managed forest, or a forest that is outstanding in some other way.

Trails – The land contains cart paths, trails, or potential links to existing trails, which are or may be useful for passive recreation.

Water Feature – The land contains surface water, wetlands, streams, ponds, or a possible site for a town well.

Special Feature – The land contains an uncommon feature, such as a special habitat, a scenic spot, or a site with archaeological, geological, or historical interest.

Rural Vista – The land provides a view of open fields or woodlands visible from any road, although visibility from a major road is more important than visibility from a neighborhood road.

Core Habitat – The land provides habitat for an endangered, rare, or protected species. Relevant information was taken from the Natural Heritage and Endangered Species Program map (Map 9).

Ecological Diversity – The land contains a variety of terrains and so provides a variety of habitats, which, in turn, may support a variety of wildlife, either flora or fauna.

Land Use – The land possesses fertile or arable soil suitable for agriculture, whether or not it is currently farmed.

Active Recreation – The land provides space for existing or potential playing fields or garden plots.

Appendix B

Carlisle Conservation Commission Rules and Regulations

Appendix B: Conservation Commission Rules & Regulations

RULES AND REGULATIONS
FOR USE OF CARLISLE CONSERVATION LAND

1. HOURS, NIGHT USE BY PERMIT
   All people are welcome to enjoy themselves on the conservation land of the Town of Carlisle. They do so at their own risk from sunrise to sunset provided such use is consistent with the Commission's rules and regulations and other applicable local, state and federal laws, rules and regulations. The conservation land and parking lots may not be used between sunset and sunrises except in accordance with a permit duly issued by the Carlisle Conservation Commission (the "Commission"). Groups of eight or more people that wish to use conservation land must obtain a use permit. This permit may be granted by one Commissioner or by the Commission Administrator, except that if said groups wish to use the conservation land in excess of four (4) daylight hours, that use permit must be duly issued by a majority vote of the Commission.

2. FIRES BY PERMIT
   Open fires are forbidden on conservation land except by permits duly issued by the Commission and the Carlisle Fire Department. The use of portable stoves does not require a fire permit, but the intention to use such stoves must be reported in writing to the Commission and the Carlisle Fire Department or noted on any use permit issued in accordance with Rule 1 hereinabove. The following fire safety measures shall apply on all conservation land: Stoves or open fires shall be at least three (3) feet from any combustible material; those making fires or operating stoves must possess an operable fire extinguisher rated consistent with the object fire and/or stove; they must also possess a spade, iron rake and water supply reasonably adequate to suppress the fire or the stove.

3. CAMPING BY PERMIT
   Overnight camping on conservation land is permitted by majority vote of the Commission, subject to obtaining all other requisite permits under these Rules and Regulations. The Police Department must be notified of exact dates and times of occupancy and must be provided with the names of the adult chaperones, as set forth below, and with emergency contact information for the camping party. Where the camping party contains two (2) or more minors, there must be at least two adult chaperones of majority age present at all times, and there must be one adult chaperone of majority age for every eight (8) minors in the camping party. Human body wastes shall be buried individually at least two hundred (200) feet from a pond or stream.

4. ARMS/FIREARMS BY PERMIT
   Arms/firearms, ammunition, bows, arrows and all other projectile weapons or devices are forbidden on conservation land, except that a majority of the Commission may issue an Arms/firearms permit for such use at Foss Farm, but only for non-hunting activities. Historically, the activities which have received permits include the colonial musters and dog training.

5. SPONSORED EVENTS AND CONCESSIONS BY PERMIT
   No one shall engage in business, sell or expose for sale or give away goods or circulars without a permit from the Commission. Applications for sponsored events will be accepted only from non-profit organizations. No admission or parking fees may be charged, but donations to the organization may be requested by posting a sign at the entrance to the event. Registration fees may be charged to participants but not to spectators in events organized by the sponsoring group. The Commission will ordinarily authorize only concessions for food to be consumed on the premises. In limited circumstances, when the Commission deems it in the public interest, additional concessions may be permitted. Although primary use of the land may be reserved for a specific event, other regular activities on the land shall continue on any given day.

6. TRAILS
   New trails or extensions of existing trails may not be installed by any person unless duly authorized by majority vote of the Conservation Commission at a public meeting.

7. PENALTIES
Without limiting any other available remedies or penalties, any person who submits false information in connection with any documentation or application required under these Rules or Regulations, or who otherwise violates these Rules and Regulations may be punished by a fine of not more than fifty dollars ($50.00) for each violation hereof. Each day or part thereof during which such violation occurs or continues shall constitute a separate violation.

CARLISLE CONSERVATION LAND USES

1. **Uses allowed on all Conservation Land**
Walking, hiking, jogging, running
Picnicking
Kite-flying
Horseback riding
Snowshoeing
Cross country skiing
Nature study (observation)
Other uses of a passive recreational nature

Uses prohibited except by special permission from a majority of the Commission
Camping
Discharge of firearms
Fires (Fire department must also issue permit)

Uses prohibited on all Conservation Land
Hunting, trapping
Swimming
Driving motorized vehicles (except by special permit and as regulated on Foss Farm)

Use by large organized groups
To be scheduled through the Conservation office

2. **Additional uses allowed on specific parcels of land**

Greenough Land
Ice skating
Fishing, ice fishing
Canoeing

Foss Farm
Pony Club activities
Dog shows
Dog field trials
Dog sledding
Dog training classes
Horse show
4-H Club activities
Fairs
Colonial Minutemen Historical Muster
Plot gardens

Towle Field
Bill Koch Ski League

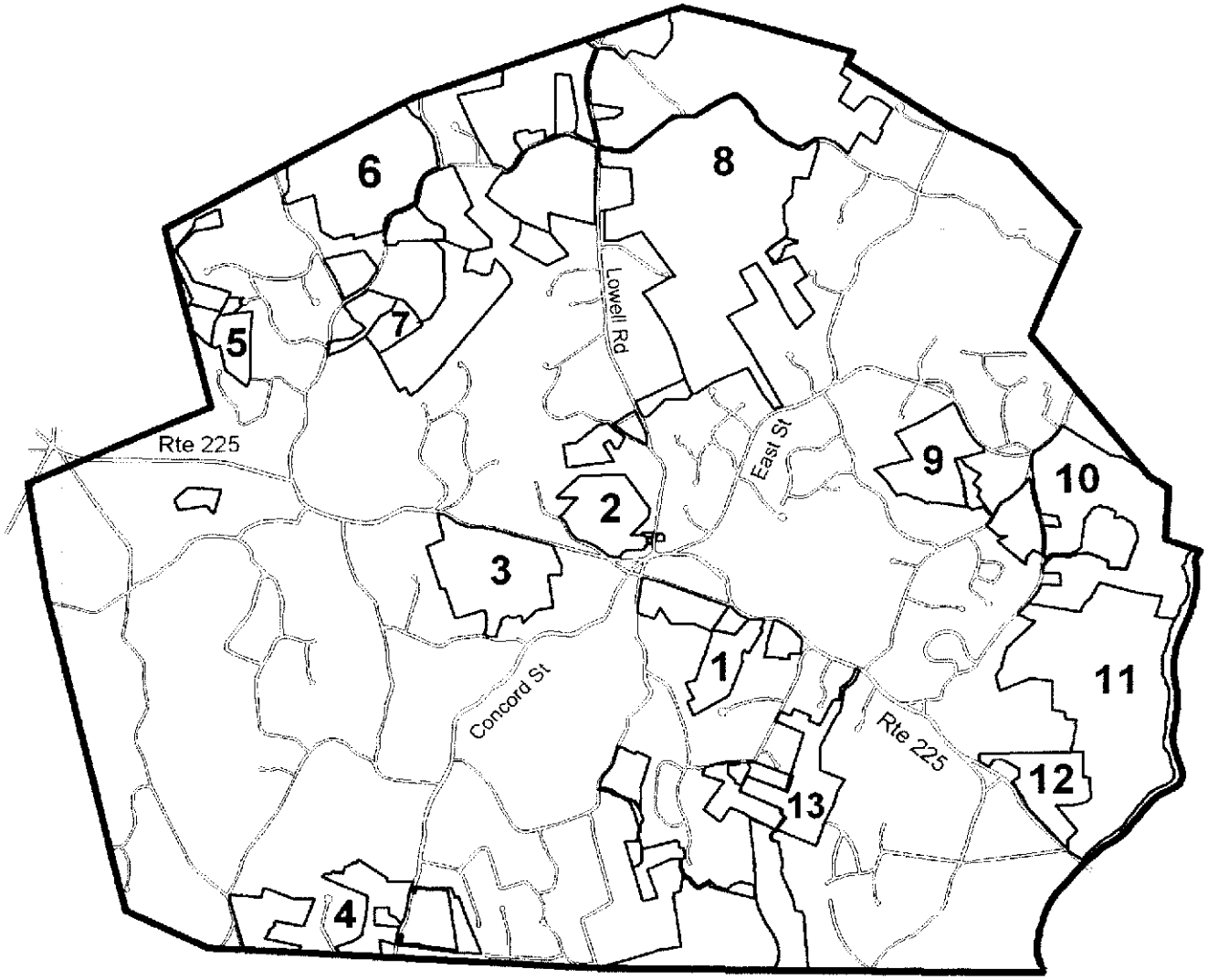
Date Adopted: February 2005

Appendix C

Carlisle
Trail Maps

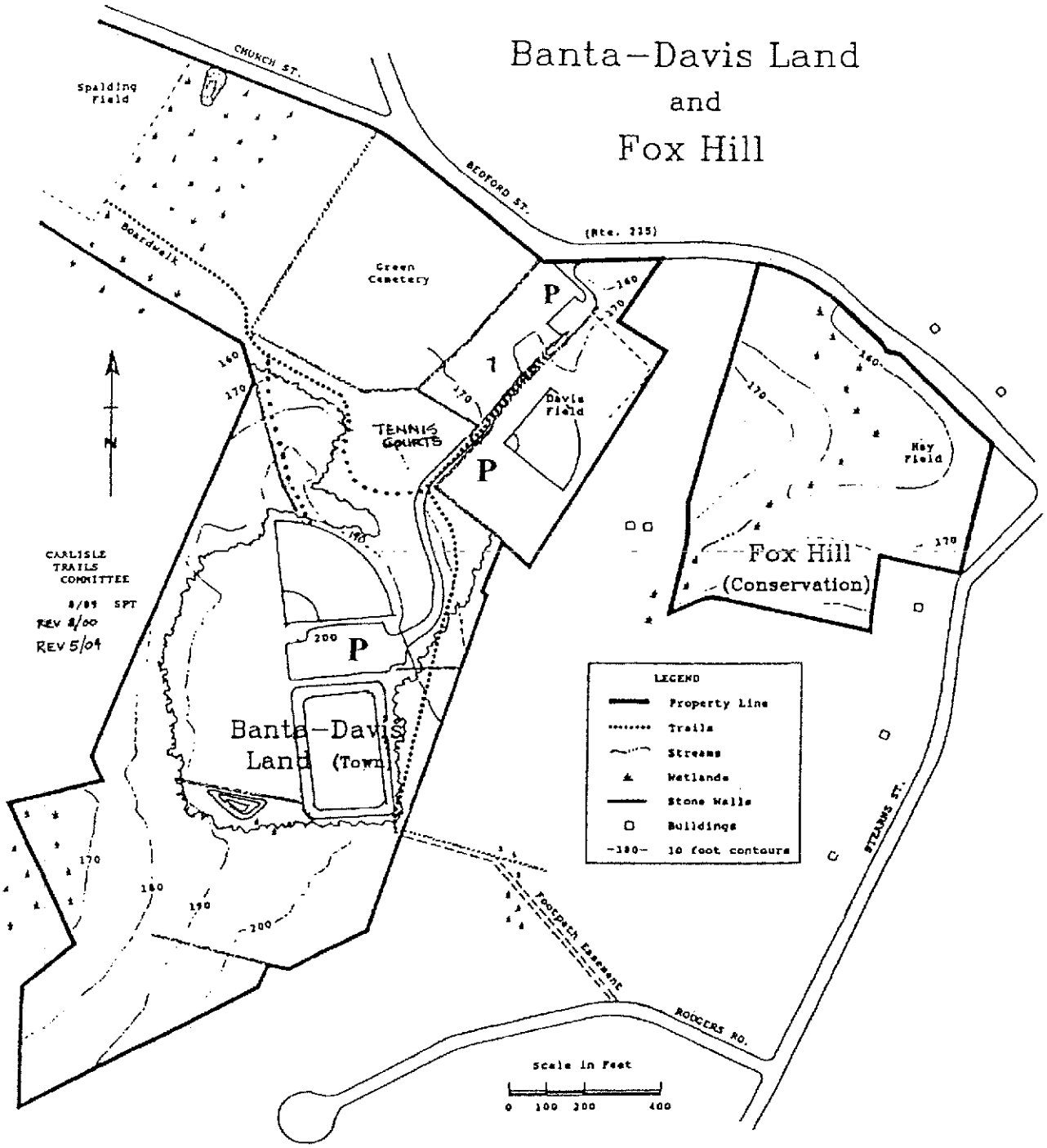
The following maps
are reprinted from the
Trails in Carlisle
2005 edition

Appendix C: Carlisle Trail Maps

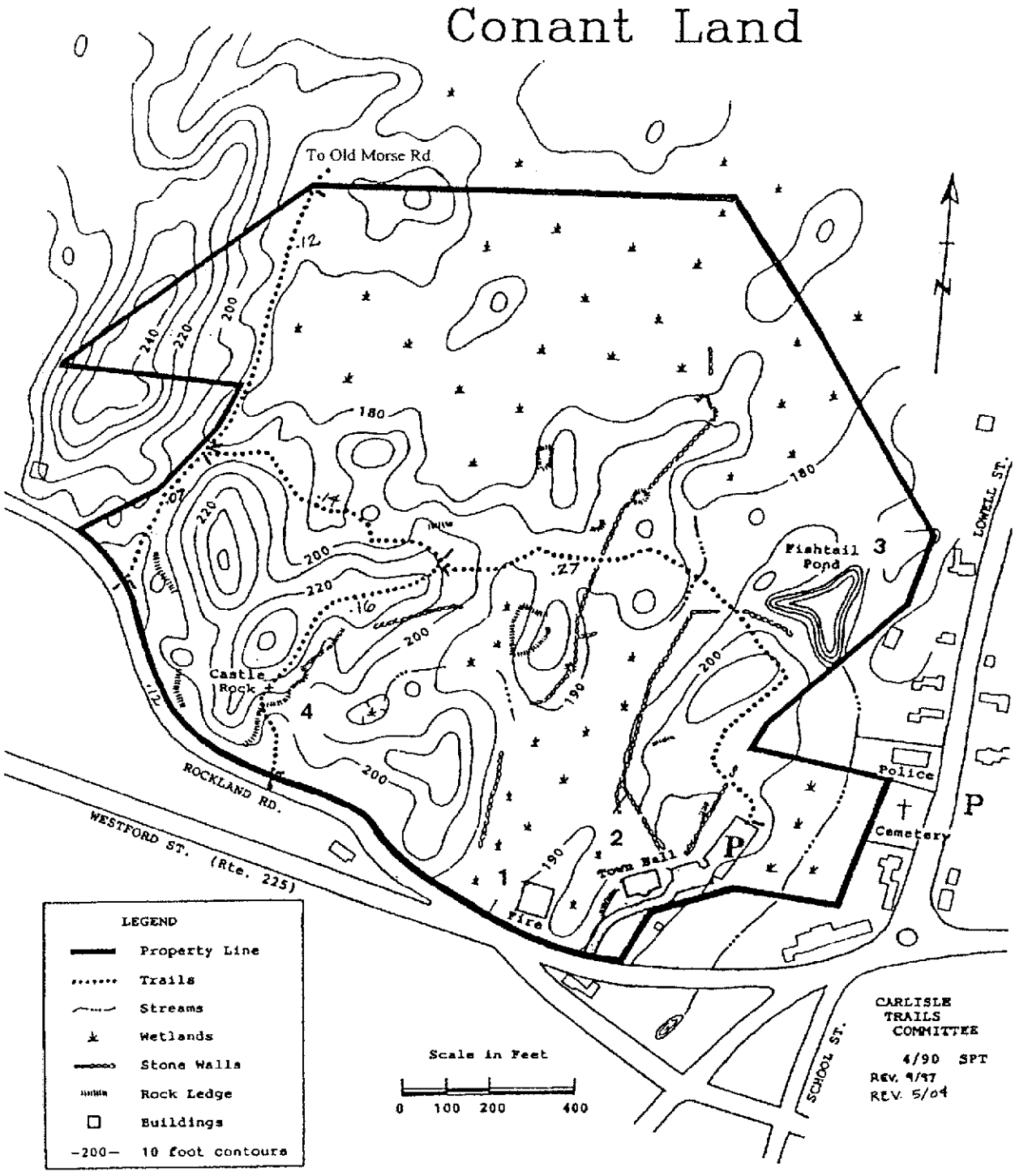


Map 1	**Banta-Davis Land & Fox Hill**
Map 2	**Conant Land**
Map 3	**Towle Land**
Map 4	**Bisbee Land, Benfield Land & Spencer Brook Reservation**
Map 5	**Carlisle Pines**
Map 6	**Cranberry Bog**
Map 7	**Curve Street Conservation Lands**
Map 8	**Great Brook Farm State Park**
Map 9	**Town Forest**
Map 10	**Greenough Land**
Map 11	**Great Meadows**
Map 12	**Foss Farm**
Map 13	**South Carlisle Trails**

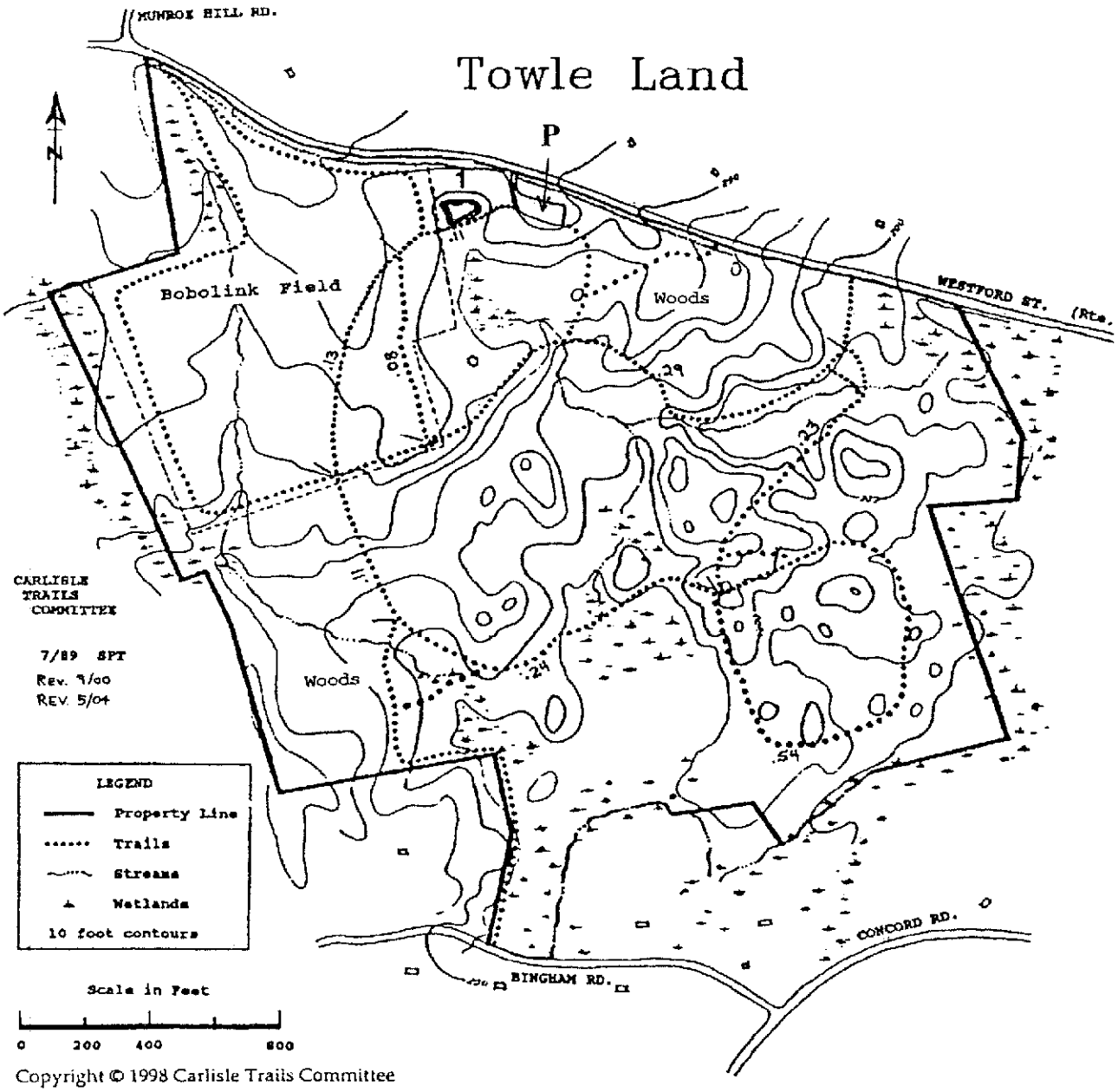
Map 1



Map 2

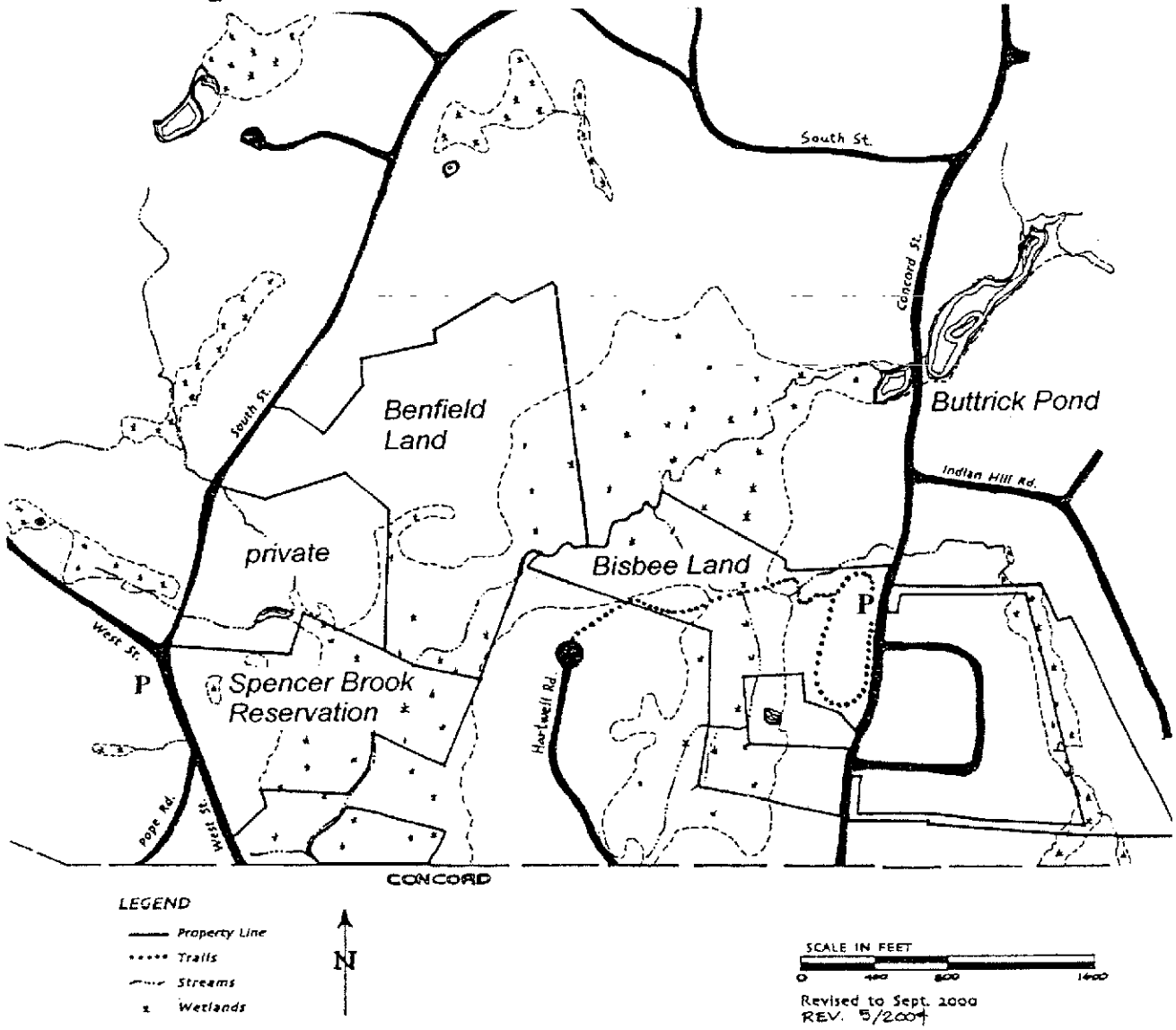


Map 3

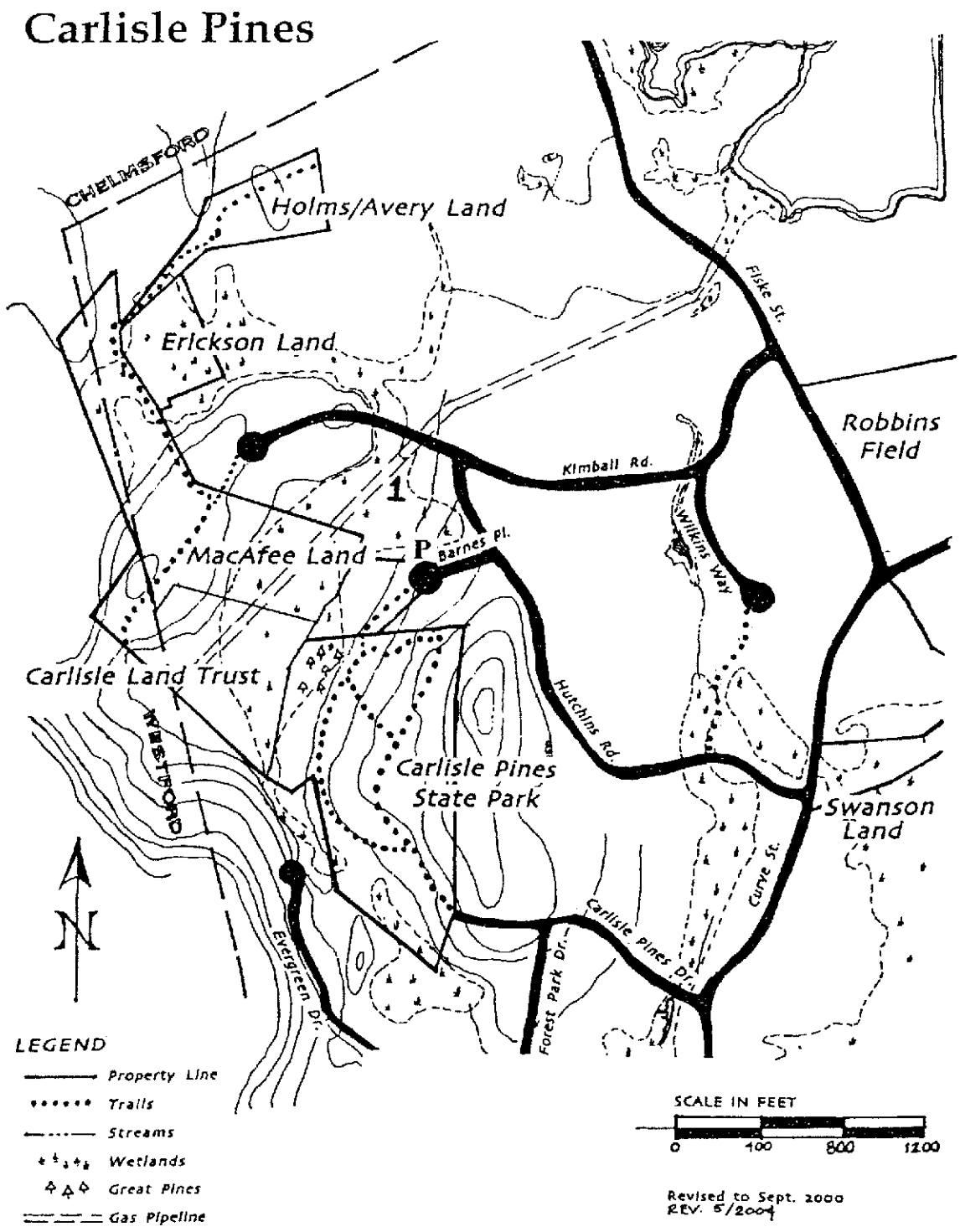


Map 4

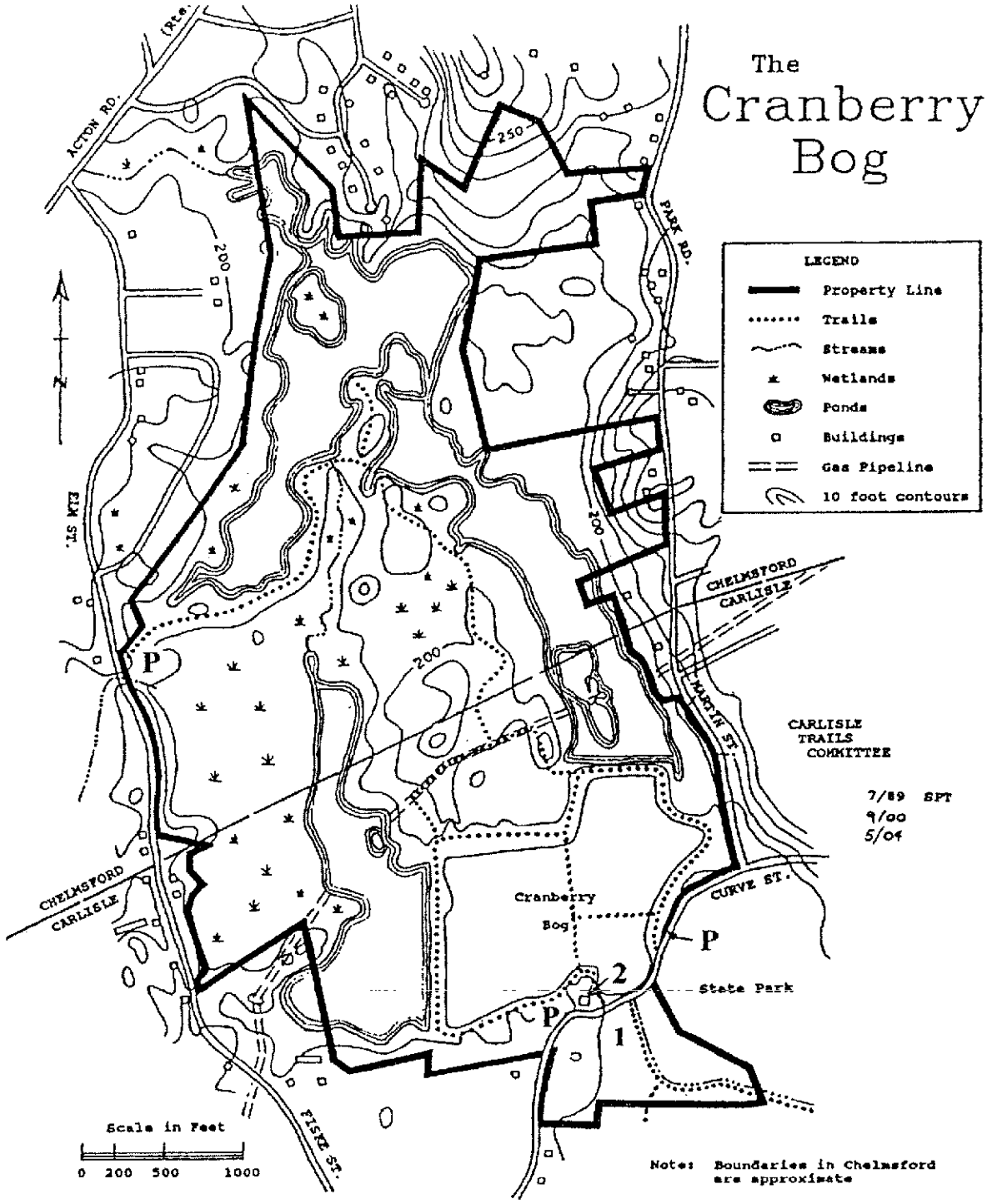
Bisbee Land, Benfield Land and Spencer Brook Reservation



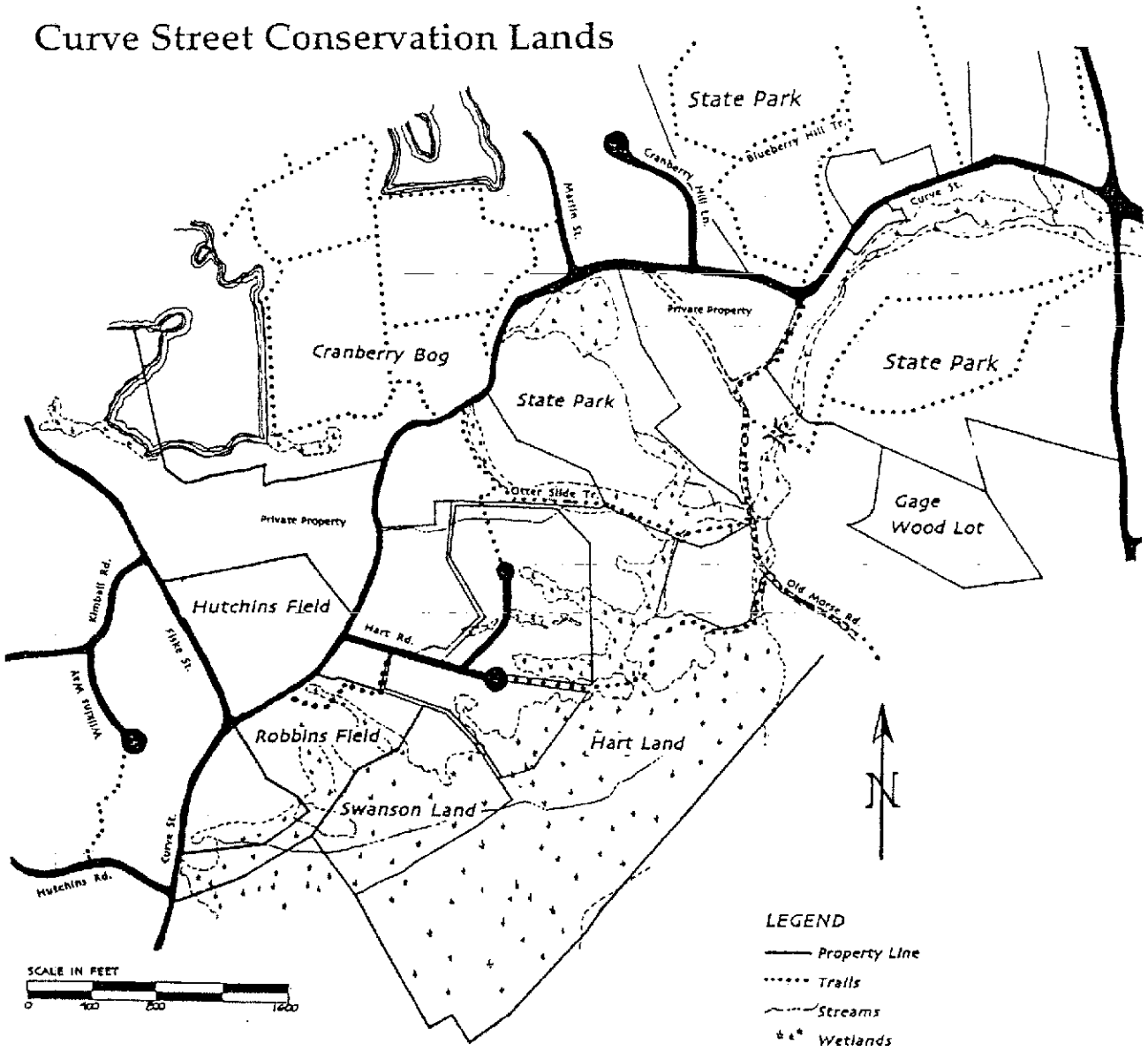
Map 5


Carlisle Pines
CHELMSFORD
Holms/Avery Land
Erickson Land
Fiske St.
Robbins Field
Kimball Rd.
1
MacAfee Land
P
Barnes pl.
Wilkins Way
Carlisle Land Trust
Hutchins Rd.
WESTFORD
Carlisle Pines State Park
Swanson Land
Curve St.
Carlisle Pines Dr.
Forest Park Dr.
Evergreen Dr.
N
LEGEND
Property Line
Trails
Streams
Wetlands
Great Pines
Gas Pipeline
SCALE IN FEET
0
400
800
1200
Revised to Sept. 2000
REV. 5/2004

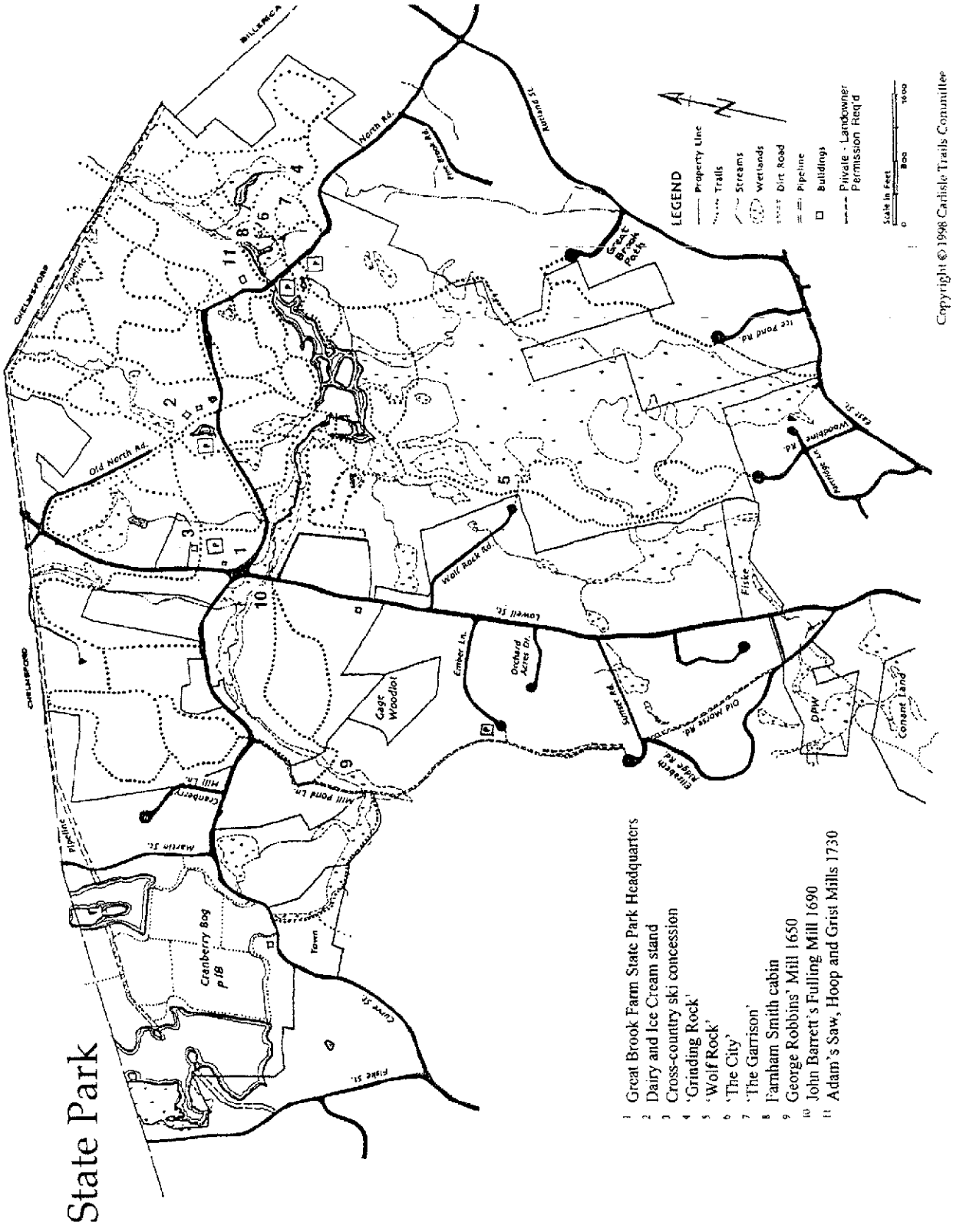
Map 6



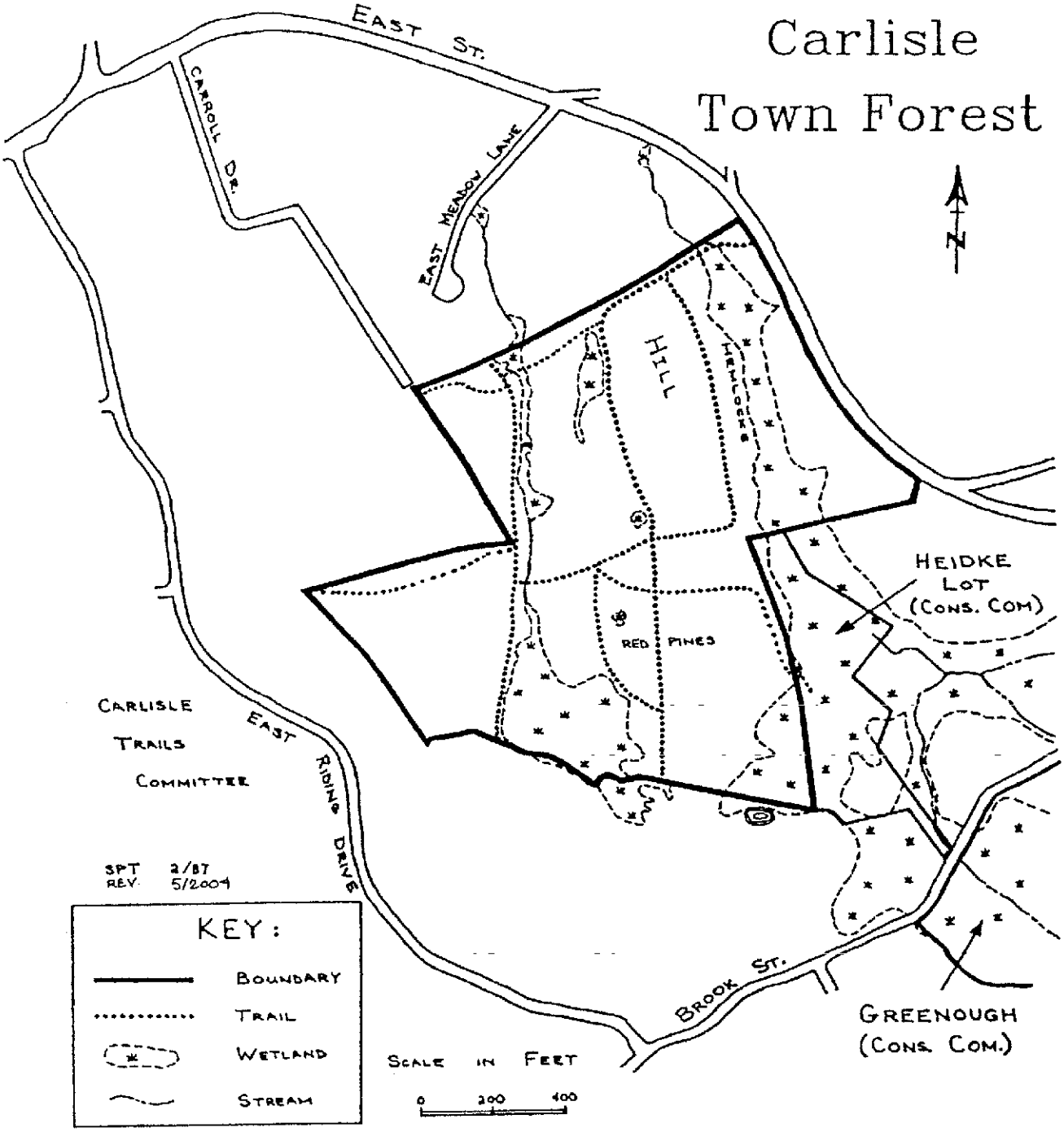
Map 7



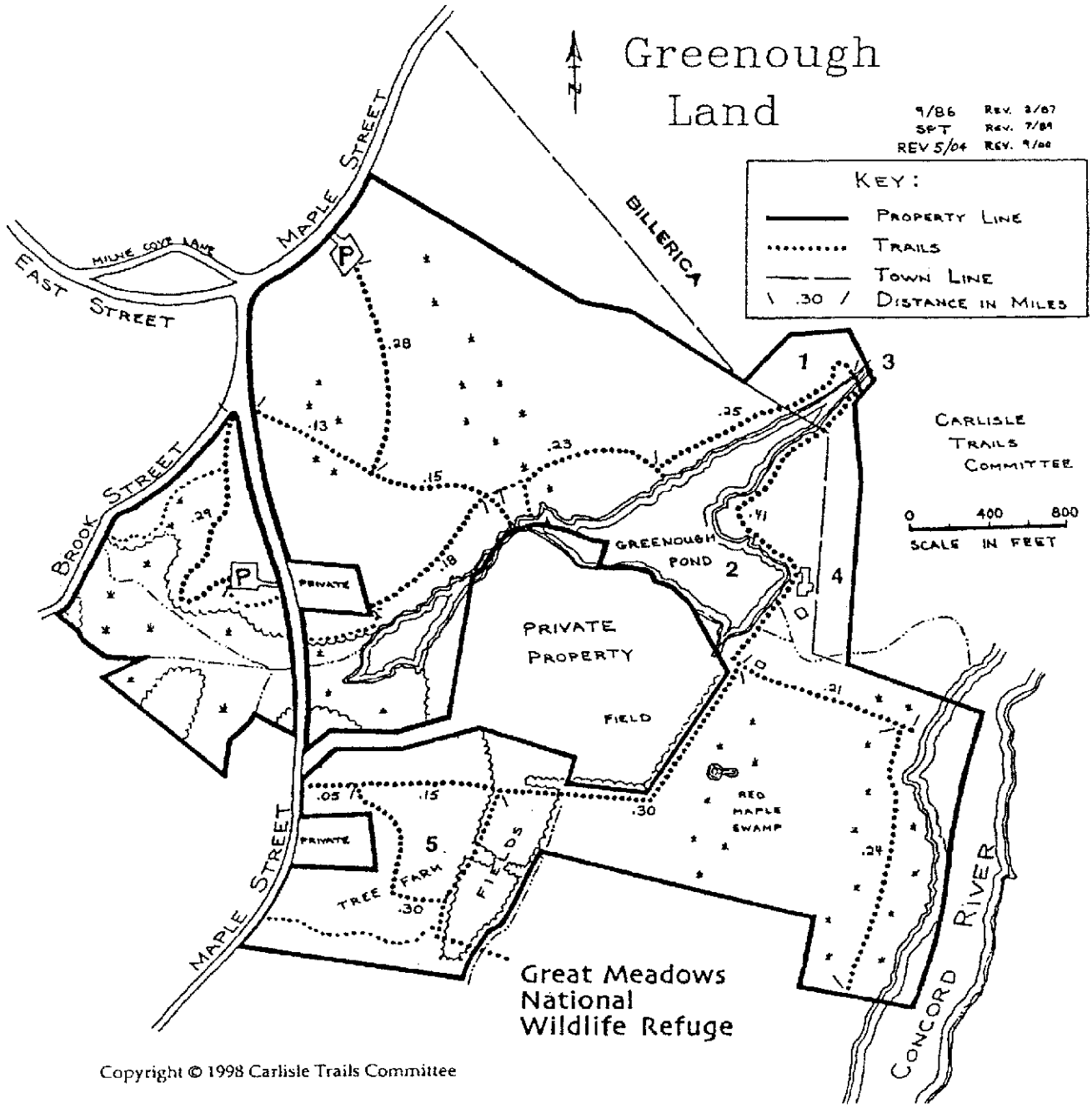
Map 8


State Park
1 Great Brook Farm State Park Headquarters
2 Dairy and Ice Cream stand
3 Cross-country ski concession
4 'Grinding Rock'
5 'Wolf Rock'
6 'The City'
7 'The Garrison'
8 Farnham Smith cabin
9 George Robbins' Mill 1650
10 John Barrett's Fulling Mill 1690
11 Adam's Saw, Hoop and Grist Mills 1730
LEGEND
Property Line
Trails
Streams
Wetlands
Dirt Road
Pipeline
Buildings
Private - Landowner Permission Req'd
State in Feet
0
800
1600
Copyright © 1998 Carlisle Trails Committee
Rev. 5/2004
Great Brook Path
Old North Rd.
North Rd.
Wolf Rock Rd.
Lowell St.
Ember Ln.
Orchard Acres Dr.
Sunset Rd.
Elizabeth Ridge Rd.
Old Mortar Rd.
Fiske
Ice Pond Rd.
Woodbine Rd.
Partridge Ln.
Clair St.
Cranberry Hill Ln.
Mill Pond Ln.
Martin St.
Curve St.
Fiske St.
Cranberry Bog
Town
DPW
Conserv. Land
Pipeline
BILLERICA
CHELMSFORD

Map 9

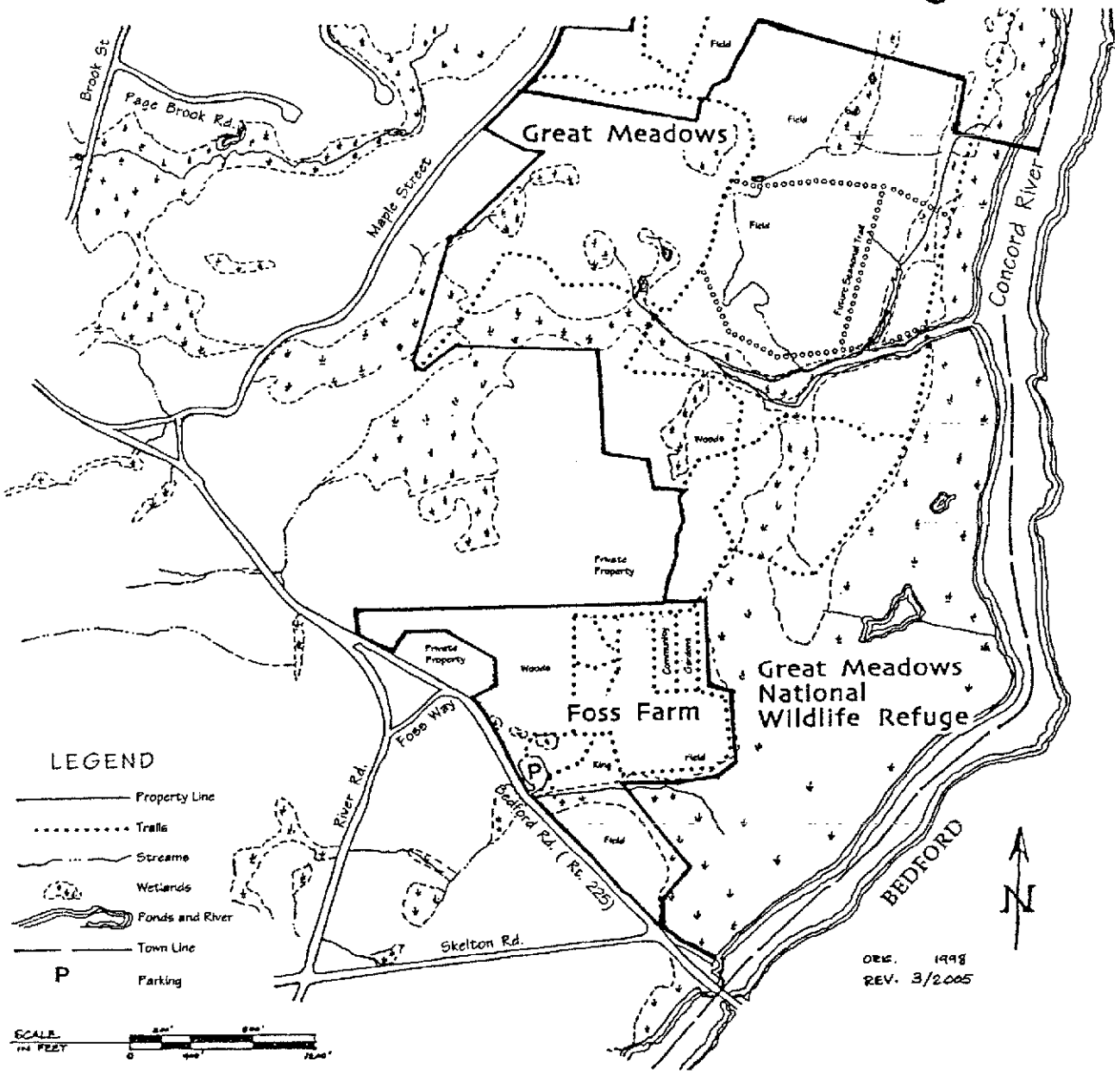

Carlisle
Town Forest
EAST ST.
CARROLL DR.
EAST MEADOW LANE
HILL
HEMLOCKS
RED PINES
HEIDKE LOT
(CONS. COM)
CARLISLE TRAILS COMMITTEE
EAST RIDING DRIVE
BROOK ST.
GREENOUGH
(CONS. COM.)
N
SPT 2/87
REV. 5/2004
KEY:
BOUNDARY
TRAIL
WETLAND
STREAM
SCALE IN FEET
0 200 400

Map 10


Greenough Land
9/86 Rev. 3/87
SPT Rev. 7/89
REV 5/04 Rev. 9/00
KEY:
PROPERTY LINE
TRAILS
TOWN LINE
.30 DISTANCE IN MILES
CARLISLE TRAILS COMMITTEE
0 400 800
SCALE IN FEET
MAPLE STREET
MILNE COVE LANE
EAST STREET
BILLERICA
BROOK STREET
GREENOUGH POND
PRIVATE
PRIVATE PROPERTY
FIELD
RED MAPLE SWAMP
TREE FARM
FIELDS
CONCORD RIVER
Great Meadows National Wildlife Refuge
Copyright © 1998 Carlisle Trails Committee

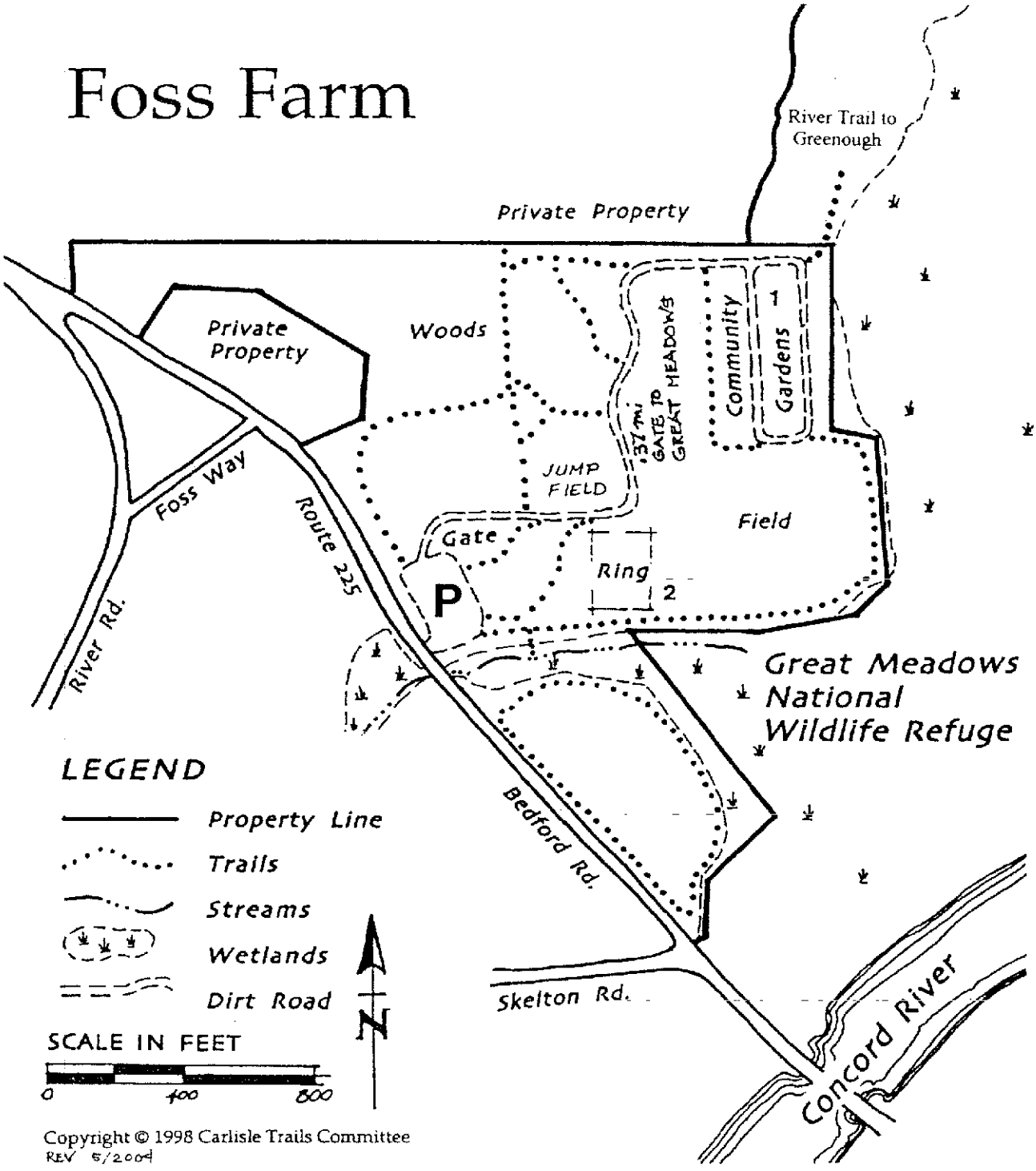
Map 11

Great Meadows National Wildlife Refuge

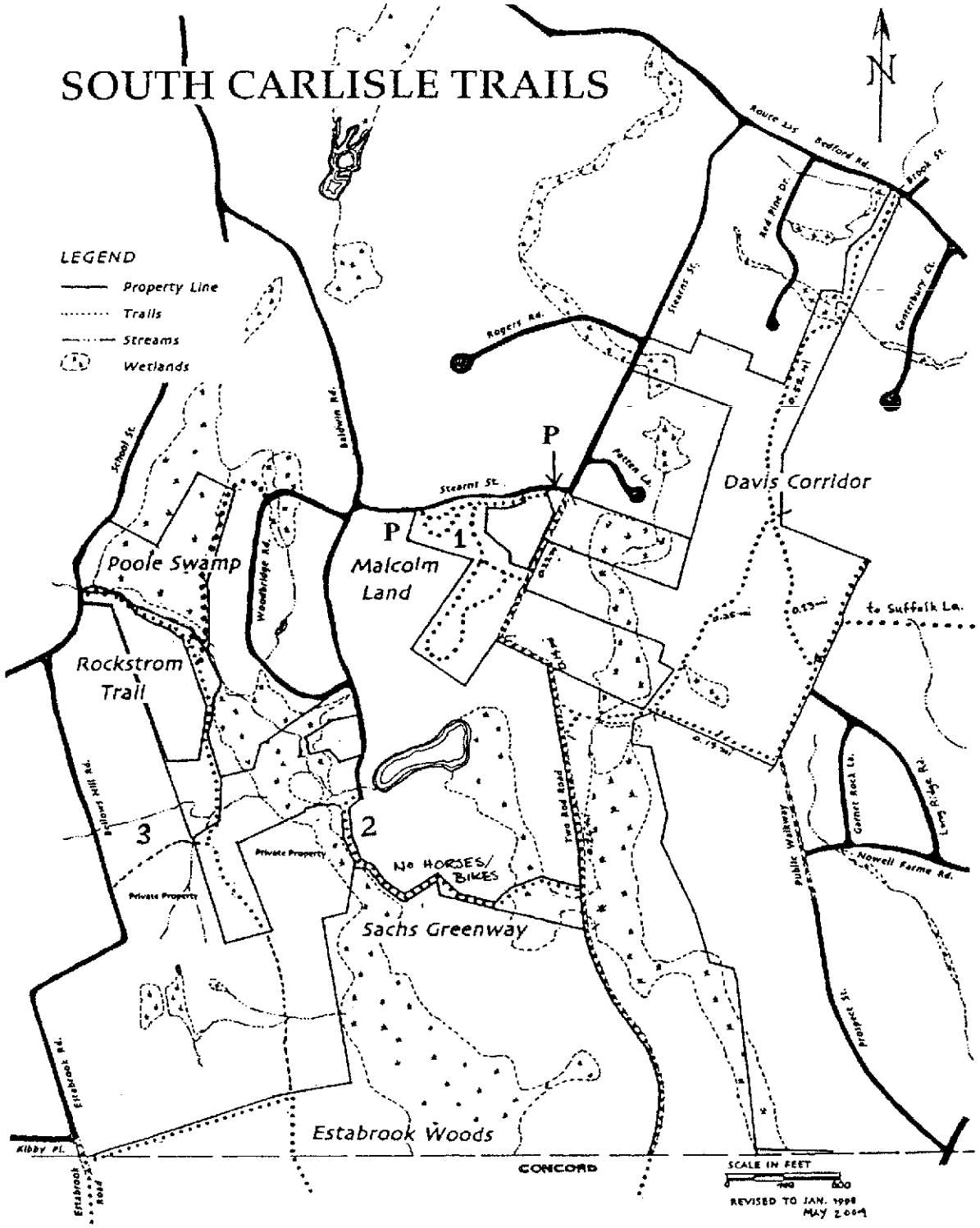


Parking for Great Meadows only at Foss Farm and Greenough.

Map 12


Foss Farm
River Trail to Greenough
Private Property
Private Property
Woods
Community Gardens 1
.37 mi GATE TO GREAT MEADOWS
JUMP FIELD
Field
Gate
Ring 2
P
Foss Way
Route 225
River Rd.
Great Meadows National Wildlife Refuge
Bedford Rd.
Skelton Rd.
Concord River
LEGEND
Property Line
Trails
Streams
Wetlands
Dirt Road
N
SCALE IN FEET
0
400
800
Copyright © 1998 Carlisle Trails Committee
REV 5/2004

Map 13


SOUTH CARLISLE TRAILS
N
LEGEND
Property Line
Trails
Streams
Wetlands
Route 225
Bedford Rd.
Brook St.
Red Pine Dr.
Canterbury Ct.
Rogers Rd.
Stearns St.
Baldwin Rd.
School St.
Stearns St.
Patten Ln.
P
Davis Corridor
P
1
Malcolm Land
Poole Swamp
Woodbridge Rd.
to Suffolk Ln.
Rockstrom Trail
Bedford Hills Rd.
3
2
Private Property
Private Property
No HORSES/ BIKES
Two Rod Road
Public Walkway
Garnet Rock Ln.
Low Ridge Rd.
Nowell Farms Rd.
Sachs Greenway
Estabrook Woods
Estabrook Rd.
Kibby Pl.
Prospect St.
CONCORD
SCALE IN FEET
REVISED TO JAN. 1998
MAY 2004

Appendix D

Natural Heritage and Endangered Species Program (NHESP) Fact Sheets: "Endangered" and "Special Concern" Species in Carlisle

Massachusetts Natural Heritage Program

Natural Heritage & Endangered Species Program
Division of Fisheries & Wildlife
Route 135
Westborough, MA 01581
(508)792-7270, ext. 200

MASSACHUSETTS RARE AND ENDANGERED PLANTS

CLIMBING FERN

(Lygodium palmatum (Bernh.) Sw.)

DESCRIPTION

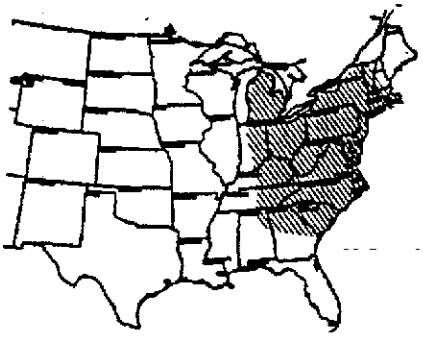
Wiley, Farida A. Ferns of Northeastern United States. Dover Publications, New York, New York. 1936.

Climbing Fern does not have the characteristic overall shape of most ferns. It is an evergreen, ivy-like plant which sprawls over the ground or climbs clockwise short distances up shrubs and coarse herbs. In very favorable conditions, Climbing Fern may carpet up to an acre of more of the forest floor. The rootstalk is black, wiry, widely creeping and branching. The root sends up a row of twining delicate fronds to a height of 3 - 5 ft (0.9 - 1.5 m). The pinnae (fern equivalent of leaflets) are alternate. The sterile pinnae consist of a forking stalk, each stalk ending in a palmately lobed yellow-green blade about 2 in (3 - 6 cm) across. The fertile blades are tiny, palmate, and produce spores on the underside. The gross morphology of this fern distinguishes it from any other species in Massachusetts.

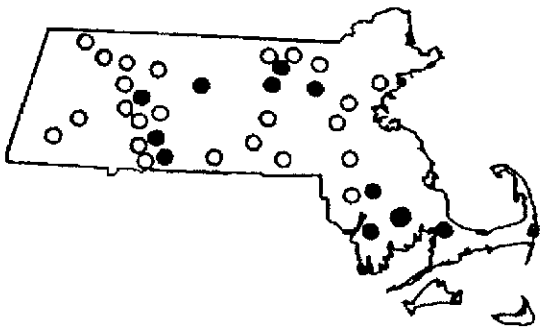
HABITAT IN MASSACHUSETTS

Climbing Fern grows in moist pine-oak-maple woods with an open understory, moist thickets and stream margins. This plant prefers acidic soils that are sandy, rich in humus, but nutrient poor. Regenerating woodlands and powerline corridors also provide habitat for this species in Massachusetts.

(continued overleaf)



Distribution of Lygodium palmatum



● Verified since 1978
○ Reported prior to 1978

Distribution in Massachusetts by Town

Massachusetts Natural Heritage Program

Natural Heritage & Endangered Species Program
Division of Fisheries & Wildlife
Route 135
Westborough, MA 01581
(508)792-7270, ext. 200

MASSACHUSETTS RARE AND ENDANGERED PLANTS

BRITTON'S VIOLET

(Viola brittoniana Pollard)

Britton, N.L. and H.A. Brown. An Illustrated Flora of the Northern United States and Canada. Dover Publications, Inc. 1970 reprint of 1913 ed.

DESCRIPTION

Britton's Violet is a perennial herb with thick underground rhizomes and slender scapes (leafless flowering stems rising from the ground), 4-8" (10-20cm.) high and mostly longer than leaves. The leaf blades are reniform (kidney shaped) to ovate and are divided into 5-9 lobes. In variety pectinata, the blades are not deeply divided, but merely sharply toothed to pectinate (comb-like) along the margins. The plant is nearly all glabrous (smooth), but the leaves are minutely pubescent (hairy) above and on the margins. Britton's Violet flowers from mid-May-mid-June and has large, 1-1½" (2-3cm.), broad flowers that are rich violet with a prominent white throat.

HABITAT

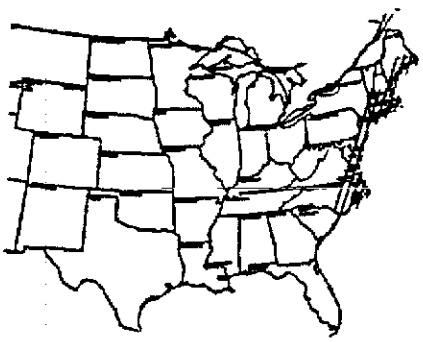
In Massachusetts, Viola brittoniana inhabits moist, sandy soils of river meadows and upper borders of open floodplain woods, generally with the habitat subject to at least occasional flooding.

RANGE

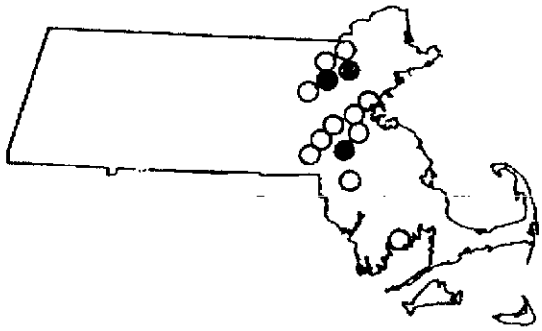
Britton's Violet ranges from southern Maine to North Carolina.

POPULATION STATUS

Britton's Violet is considered to be a "Threatened" species in Massachusetts. Historically (prior to 1978), there have been 14 documented occurrences; since 1978 there have been only 3 occurrences verified. Much of its habitat in the state has been altered by damming and diking of rivers and conversion of floodplain meadows to agriculture.



Distribution of Britton's Violet



● Verified since 1978
○ Reported prior to 1978

Distribution in Massachusetts by Town

The members of the complex form a continuum in appearance from the grayish-brown coloration, pale blue flecks, and wide snout of the Jefferson Salamander to the bluish-black coloration, prominent blue spots, and narrow snout of the Blue-spotted Salamander. The two main hybrid forms are best identified by chromosome counts or size of red blood cells in conjunction with their external appearance: the Silvery Salamander is almost identical to the Jefferson Salamander but is smaller, and the Tremblay's Salamander closely resembles the Blue-spotted Salamander but is somewhat larger.

RANGE: Blue-spotted Salamanders can be found discontinuously from the northern shore of the Gulf of St. Lawrence across southern Canada to Lake Winnipeg and south to New England, New York, and the northernmost parts of Ohio, Indiana, and Illinois. Disjunct colonies also exist in Labrador, Canada; Long Island; northern New Jersey; and Iowa. In Massachusetts, they occur predominantly within Middlesex and Essex counties and in the adjacent eastern towns of Worcester county. Some occurrences lie within Bristol and Plymouth counties as well. In general, Jefferson-complex salamanders found east of Worcester County's western border are likely to be either Blue-spotted Salamanders or Tremblay's Salamanders.

HABITAT IN MASSACHUSETTS: Blue-spotted Salamanders require moist, moderately shaded environments; they favor northern hardwood/hemlock forests occurring in glaciated areas having depressions available for seasonal flooding. The resulting vernal (temporary) ponds necessary for breeding and egg laying are seldom more than 30–40 cm (12–15 in.) deep. Ponds need to be full of dead and decaying leaves for cover and overhanging bushes and grass for egg deposition. Roadside drainage ditches, small kettle holes, and temporary pasture ponds also provide habitat when flooded in the spring.

LIFE CYCLE/ECOLOGY: A cryptic species, Blue-spotted Salamanders are rarely encountered above ground, except during their early spring breeding season, or as just-metamorphosed juveniles in the late summer. Adults reside most of the year beneath leaf litter or underground to a depth of one meter, usually within 500 meters of their breeding pond. The breeding season is brief, lasting from mid March to late April. As soon as the ground surface thaws, males migrate above ground to temporary ponds; females join them in a few days. An elaborate courtship of approach, contact, nudging, and tail-fanning routines takes place in the water. Females then pick up a deposited spermatophore and store it in the cloaca for egg fertilization. (Normal sexual reproduction occurs in the diploid females, while no true fertilization or recombination takes place in the triploid hybrids.) Eggs are often laid singly, with 6 to 10 eggs per mass, for a total clutch ranging from 82 to 489 eggs. The egg masses cling lightly to overhanging vegetation or fall to the bottom of the pond. Hatching about a month later, larvae are voracious eaters, preying on insect larvae and other small aquatic animals. No overwintering of larvae has been reported in Massachusetts, so by late August larvae have metamorphosed completely into air-breathing adults.

Adult Blue-spotted Salamanders feed on small invertebrates such as larval and adult insects, spiders, worms, and centipedes. They produce noxious skin secretions from specialized poison glands and are thus rarely preyed upon by native predators. If Blue-spotted Salamanders reach adulthood and their habitat is secure, they may live for decades. Except when breeding, adults probably move around within territories of less than one square meter.

POPULATION STATUS IN MASSACHUSETTS: The Blue-spotted Salamander (including triploid and other polyploid forms within the A. laterale/A. jeffersonianum complex) is currently listed as a "Species of Special Concern" in Massachusetts. Ninety-nine current populations (1978 to the present) have been documented, as well as 22 historical populations (prior to 1978). The major threat to this species—and most salamanders in general—is the loss of wetland habitat to draining, development, and other causes. For example, making temporary ponds deeper and permanent results in fish populations which predate amphibian eggs and larvae. Some population declines may also be attributed to sample overcollection, foot and road traffic, and pesticides or other toxic chemicals. Studies on the effects of acid rain on salamander eggs and larvae have been contradictory, and further studies must be made to resolve this issue, however, it appears that Blue-spotted Salamanders from eastern Massachusetts are highly tolerant of acid conditions and can hatch successfully down to a pH of 4.0.

SUGGESTED GUIDELINES FOR TIMBER HARVESTING NEAR VERNAL POOLS

Vernal pools provide critically important habitat for a number of rare and endangered species in Massachusetts. Certain precautions should be taken when harvesting in the vicinity of such pools to minimize impacts and preserve the character and physical environment that these species require. Although these pools may only actually be filled with water for a brief period of time in the spring, the most important measure that can be taken to protect the habitat is to recognize pool locations even in the "dry" season and take precautions to preserve the local environment around the pools. Recognizing these seasonal pools and considering the following guidelines will help protect these critical habitats:

1. Heavy equipment should not be permitted in vernal pool depressions at any time of the year. Avoid locating landings, skid roads, or haul roads through or near these depressions. It is important that the depressions not fill in with sediment from nearby areas of disturbed soil.

2. Similarly, do not stack logs or otherwise create soil compaction in vernal pool depressions.

3. Avoid operating logging machinery within approximately 50 feet of a vernal pool during mud season. Ruts deeper than 6 inches can disrupt migration routes of endangered salamanders. There should be no ruts deeper than 6 inches within 200 feet of a vernal pool. Similarly, the actual vernal pool depression should not be physically altered so that its ability to seasonally hold water is impaired.

4. Tree tops or slash should not be allowed to fall or be placed into vernal pool depressions. While many amphibians use downed woody material to attach their eggs to, no additional material should be added to a pool. If tops or branches do fall into a depression, they should be removed. Similarly, existing natural woody material should NOT be removed from vernal pool depressions.

5. It is important that the temperature and relative humidity at the soil surface be maintained in the cool, moist condition necessary for amphibians that use vernal pools. Thus, it is important that these vernal pools, and an area within 50 feet of these pools, be maintained in a shaded and mostly undisturbed condition.

   a. Do not clearcut these areas. Some forest cover must be maintained to provide continuous shade and protection from high temperatures at the soil surface. Do not leave only trees with small or damaged tops, or those that appear to be dead or dying. Established understory vegetation such as mountain laurel, hemlock, or naturally established advanced regeneration can provide shade. Similarly, shade can be provided by vigorous hardwood sprouting following a harvest.

   b. Avoid disturbance of the mineral soil within 50 feet of a vernal pool depression for several reasons. First, it is important that sediment not accumulate in vernal pool depressions. Second, the exposure of mineral soil removes the natural insulation provided by the accumulated litter on the forest floor. This litter can be several inches thick and can keep actual soil moisture and temperature from getting too high, even if exposed to direct sunlight. For these reasons, it would be best to operate in the vicinity of vernal pool depressions when the ground is frozen and covered with snow. Under other dry conditions, it would be advisable to not operate machinery within 50 feet of a pool depression, and to winch timber (if any is cut within this radius) out of this area. Finally, it would be advisable not to operate within 50 feet of a vernal pool depression during mud season, so as to not create ruts.

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(Necturus m. maculosus) has only four toes. The Mudpuppy, however, is much larger in size, 20–33 cm (8–13 in.), has external gills, and has neither the belly pattern nor the constricted tail of the Four-toed Salamander. Redback Salamanders (Plethodon cinereus) may be similar in size and general color, however, they have five toes on their hind feet, and also lack the tail constriction and white and black belly pattern of the Four-toed Salamander.

RANGE: Four-toed Salamanders occur from southern Maine, Quebec, Ontario, and northern Wisconsin southward to North Carolina, South Carolina, Georgia, Alabama, and Tennessee. Disjunct populations occur in Nova Scotia, Missouri, Arkansas, Louisiana, Georgia, and Florida.

HABITAT IN MASSACHUSETTS: Breeding habitat, in the form of wetlands with hummocks of grasses, sedges or wet moss (usually sphagnum moss) adjacent to slow moving streams or pools of standing water, is an important factor limiting the occurrence of Four-toed Salamanders throughout their range. In Massachusetts, this species breeds in bogs, swamps dominated by red maple (Acer rubrum) and Atlantic white cedar (Chamaecyparis thyoides), vernal pools, and other perennial wetlands with sphagnum or other mosses. As a result of their preference for wetlands dominated by sphagnum, they are quite tolerant of acidic conditions. Larvae are found in small pools and slow moving streams associated with nesting areas. The adults are terrestrial and are generally found in forested areas near their breeding habitat. Four-toed Salamanders take refuge in wet moss, under fallen logs and other objects, in rotting wood, under stones or in the leaf litter. Distribution is limited to areas that provide both breeding and upland habitats in close proximity.

LIFECYCLE/BEHAVIOR: The Four-toed Salamander is an inconspicuous little creature and because of its small size and retiring habits is seldom observed. When one is uncovered, it may slip quickly beneath the humus with lizardlike speed, or lie motionless, relying on cryptic coloration. If threatened, it will curl and raise its lighter-colored tail above its back, offering a piece of tail in exchange for its life. The tail is fragile and easily detached at the constriction near its base. The salamander can even cause the loss of its own tail by pushing against an object. The detached part of the tail wriggles violently for several minutes, a temporary distraction to a potential predator that enables the salamander to escape. A new tail is soon regenerated.

The Four-toed Salamander reaches sexual maturity during its third year. The breeding season for this species lasts from late summer (early August) through fall (October). Mating and courtship take place on land and consist of the male rubbing his snout, lips, or the side of his body against the female's snout. Sperm are then transferred to the female by means of spermatophores, small packages of sperm, which are deposited on the substrate and then picked up by the female and held in her cloaca until the following spring. Spermatophores for this species are 2 mm high.

This species hibernates in and under rotting wood and leaves as well as in the channels of decaying tree roots. They have a tendency to clump together in small to rather large groups to hibernate , often in association with spring peepers, wood frogs, newts, and other species of salamanders. The Four-toed Salamander is one of the earliest to emerge from hibernation in the spring appearing from late March to early May. The females begin to migrate to suitable nesting sites at this time. These nesting sites are generally simple little cavities in the sphagnum moss, but the underside of stumps, rotten logs, leaf litter, and grass hummocks may also be used. They are invariably placed in the vicinity of water; usually 2–6 in. immediately above it, enabling the larvae to fall directly into the water after hatching. The nest cavity often has the appearance of being formed by turning movements of the female, but in some instances it is evident the female merely takes advantage of a natural opening in the moss or some hollow between the roots of a bog plant.

The eggs are laid from mid-April into June, depending on local climatic conditions. The female turns upside down, grasping rootlets and bits of moss with her feet while slowly forcing the eggs out into the nest cavity. The egg laying process requires several hours to complete. The eggs are laid singly, but adhere in a cluster. The number of eggs per clutch varies from 19 to 50; each egg being 5–6 mm in diameter. Communal nesting may occur with up to 800 eggs laid in a single nest. Females remain with their eggs throughout the incubation stage, generally 38 to 60 days, and desert the nests prior to hatching. If the nest is a communal one, only a few females will attend the eggs. The larvae are about 1.2 cm long when they hatch. They wriggle until they drop into the water. The larvae grow to 1.8–2.5 cm (.75–1.0 in) over a period of 6 weeks; although the larval period may last up to 18 weeks depending on pond conditions. At that time, the larvae transform into adults and leave the water.

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(Hemidactylium scutatum)

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SIMILAR SPECIES IN MASSACHUSETTS: The habitat of the Eastern Box Turtle (Terrapene carolina) and the Blanding's Turtle (Emydoidea blandingi) may overlap that of the Wood Turtle, but neither has the Wood Turtle's pyramidal shell segments. Unlike the Wood Turtle, the Box and Blanding's Turtle have hinged plastrons into which they can withdraw or partially withdraw if threatened. The Northern Diamondback Terrapin (Malaclemmys terrapin) has a shell similar to that of the Wood Turtle, but its skin is grey and it lives only near saltwater (which the Wood Turtle avoids).

RANGE: The Wood Turtle can be found throughout New England, north to Nova Scotia, west to eastern Minnesota, and south to northern Virginia.

HABITAT IN MASSACHUSETTS: The preferred habitat of the Wood Turtle is riparian areas. Slower moving streams are favored, with sandy bottoms and heavily vegetated stream banks. The bottoms and muddy banks provide hibernating sites for overwintering, and sandy or gravelly banks are used for nesting. The Wood Turtle spends most of the spring and summer in meadows and upland forests and returns to the streams in late summer or early fall to mate and overwinter. During the day, it is often seen in woodlands, hayfields, and along roadsides adjacent to streams.

LIFECYCLE/BEHAVIOR: The Wood Turtle has a way of life that makes it at home either in or out of the water. Next to the box turtle, it our most terrestrial species; possessing exceptional intelligence and a unique climbing ability. In southern or coastal areas of its range, the Wood Turtle becomes active in late March, but elsewhere it is usually mid-to late April or even May before it is sighted. Upon coming out of hibernation, the Wood Turtle begins its terrestrial activity by moving up on the river bank to bask in the sun. This species is diurnal (active by day), foraging in midday and sunning on logs in streams or along muddy river banks in the early morning and late afternoon. It is this habit of basking on the muddy river banks which has given the Wood Turtle the popular name "mud turtle." The Wood Turtle leads a rather solitary life and rarely will one find more than a single wood turtle at a time.

Wood Turtles remain relatively close to their streams and rivers, rarely getting more than a few hundred meters away from the banks. They have relatively linear home ranges that tend to run up to 1.6 km (a mile) in length. Males have been observed exhibiting aggressive behavior such as chasing, biting, and butting both during the mating season and at other times. This behavior appears to be more about social status than territorial ownership. Typically, one or both males make an "open mouth" gesture, snapping open and closing the mouth near the other's head, rarely resulting in actual biting. Prolonged interactions are often accompanied by audible hissing from one or both animals. Females tend to be more peaceable; interactions seldom involve more than a simple nose touching and departure.

The Wood Turtle becomes sexually active in the spring when the water temperature reaches 15 C (59 F). This species has a courtship ritual involving a "dance" that takes place for several hours prior to mating. The dance involves the male and female approaching each other slowly with necks extended and their heads up. Before they actually touch noses, they lower their heads and swing them from side to side. Courting adults may produce a very subdued whistle that is rarely heard by observers. These courtship behaviors occur on land, yet actual mating appears to take place only in the water.

The female Wood Turtle wanders in search of a nest site in late May or mid-June. She often digs her nest during or just after a slight rainstorm. Nest-digging can begin relatively early in the morning or late in the afternoon. The female Wood Turtle generally digs several six-inch holes before deciding on a definite nest site. The function of this may be to confuse nest predators that are searching for buried eggs. The female digs her nest using her hind feet only. The nest is a six-inch hole dug in sandy or soft loam sand areas, including gravel banks, roadsides, fields and meadows. It is generally high enough out of the river's floodplain to avoid inundation by fluctuating water levels. A clutch of 4 to 12 (generally 7 to 9) eggs are deposited inside the nest, covered with sand, and left to incubate for ten to sixteen weeks in the warmth of the sun. The eggs are white, smooth, and elliptical measuring 3.4 cm (1.4 in) in length and 2.4 cm (0.95 in) in width. From beginning to end, the nesting process may take three or four hours. Wood turtles lay only one clutch per year.

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NESTING HABITS

Female Blanding's Turtles reach sexual maturity and begin breeding at about 12 years of age. Females select unvegetated nest sites that are composed of hard soil. Plowed fields, railroad embankments, and dirt roads provide a suitable substrate. Eggs are usually laid at the end of June with emergence occurring in late September or early October. Clutch size ranges from six to eleven eggs.

POPULATION STATUS

The Blanding's Turtle is listed as Threatened by the Massachusetts Division of Fisheries and Wildlife. As this turtle is relatively difficult to study, it is not known how great a decline this species has experienced in comparison to earlier years. In Massachusetts, only seven nesting sites are currently known containing an undetermined number of individuals. A variety of factors are attributed to this species' low numbers. Development has destroyed appropriate habitat by altering the land and introducing human related impacts such as pet predation, road mortality, and vandalism. Hatchlings are especially vulnerable to these threats as well as to natural predation by fishes, bullfrogs, snakes, birds, and mammals. The presence of these threats in addition to the species' natural characteristics of late maturation age and low rate of reproduction (less than one-half of breeding age females reproduce yearly), make it difficult for the Blanding's Turtle to thrive.

Hatchlings have a flat, brownish-gray carapace with a yellow spot on each large scute; and yellow along the outer rim of the carapace, the mid-dorsal keel, and the lower mandible. The plastron is yellow to cream-colored with a black central blotch and yellow margining along the outside edge. The plastal hinge is not functional and poorly developed. The tail is long in comparison with that of the adult. Hatchlings, if molested, emit a strong odor to repel predators; an adaptation that is lost later on.

SPECIES SIMILAR IN MASSACHUSETTS: The Blanding's Turtle (Emydoidea blandingi) is the only species of turtle in Massachusetts that resembles the Eastern Box. Often referred to as the "semi-box turtle," the Blanding's Turtle has a hinged plastron enabling the turtle to pull its exposed part upwards towards its carapace but with less closure than in the Eastern Box Turtle. Outside of this specific adaptation, there is little or no similarity either in appearance or behavior between the two species. The Blanding's Turtle is essentially aquatic whereas the Eastern Box Turtle is terrestrial.

RANGE: The range of the Eastern Box Turtle is from southeastern Maine; south to northern Florida; and west to Michigan, Illinois, and Tennessee. Although the Eastern Box Turtle occurs almost statewide in Massachusetts, the majority of the population occurs in the southeastern section of the Bay State, just west of Cape Cod.

HABITAT IN MASSACHUSETTS: The Eastern Box Turtle is a woodland species, although in the northeast it also occurs in pastures and marshy meadows. It is found in both dry and moist woodlands, brushy fields, thickets, marshes, bogs, stream banks, and well-drained bottomland. It prefers open deciduous forests but has also been found on mountain slopes in Massachusetts. In optimal habitats in Cape Cod pine barrens and oak thickets, the species is generally associated with cranberry dominated swales interspersed with bearberry ground cover, low bush blueberries, and thickets of bracken fern.

LIFECYCLE/BEHAVIOR: The Eastern Box Turtle usually hibernates in the northern parts of its range from late October or November until sometime in April. In the deep south, it may remain semiactive throughout the winter. Hibernation generally begins at the time of the first killing frost. As many as four box turtles may share the same winter quarters, which range in type from loose soil, sand, vegetable debris and mud bottoms of ponds or streams to animal burrows or stump holes. As soil temperatures drop, the turtles burrow into the soft ground for a depth of from three inches to two feet. Females tend to hibernate first, with the males lingering to ensure that all females have been fertilized. They normally emerge from hibernation in April, but some individuals may emerge prematurely during warm spells in winter and early spring and perish from exposure.

Mating may take place as soon as the turtles emerge from hibernation or at any time until they enter hibernation again. Courtship begins with the male circling the female and biting at her shell, head, and legs, before mounting. Females nest from May to July and can lay fertile eggs up to four years after a single mating. Nesting areas may be in hay fields, roadsides, cultivated gardens, lawns, beach dunes, and woodland, and around house foundations. The eggs are deposited in a flask-shaped nest dug by the female's hind feet in loose soil at an elevated site, usually in an open area in close proximity to the previous years' nest. Egg laying occurs during the late afternoon-early evening and continues for up to five hours. Three to eight (usually four or five) thin, white, elliptical eggs are deposited by the female at intervals of one to six minutes; arranged in the nest by the hind feet; and then covered with soil by the hind legs and plastron. After the eggs are covered, the female crawls away, leaving the eggs unattended to incubate. The incubation period depends on soil temperature but generally the hatchlings emerge about 87–89 days after laying, usually in September. They may overwinter in the natal nest and emerge the following spring.

During the first four or five years of life, box turtles may grow at a rate of from half an inch to about three-quarters of an inch a year. Sexual maturity is thought to occur later in New England than in its southern range and may take up to 10 years to attain. It is believed that full growth is reached in about 20 years. The average life expectancy of a box turtle is between 40 and 50 years, but evidence shows that they can live as long as 80 to 123 years.

The Eastern Box Turtle is omnivorous, showing marked changes in food preferences from youth to maturity and from season to season. When young, it is chiefly carnivorous, feeding on insect larvae, slugs, earthworms, snails, spiders, crayfish, millipedes, fish, frogs, salamanders, a small percentage of vegetable material, and even carrion. At

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