A Survey of the Army Corps of Engineers' Union Village Dam Project Area for Vernal Pools and Rare or Protected Reptiles and Amphibians

Prepared for

The Vermont Field Office of
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Introduction

The purpose of this contract was to generate a thorough survey of the US Army Corps of Engineers' property at Union Village Dam in Thetford, Vermont for rare or protected reptiles and amphibians and to locate and briefly describe any significant vernal pools. I will here report on all reptiles and amphibians (herptiles) located in the study paying particular attention to those with a Vermont State Heritage rank of S3 or lower and/or a global rank of G4 or lower. All vernal pools which appeared to be important amphibian breeding locations are shown on maps (Figure 1) and briefly described (Table 3).

The definition of a vernal pool which I will use is: a temporary or semipermanent pool which has no permanent inlet or outlet and is filled by local surface water in the spring. At this particular site there are also pools which are filled by water backing up from the dams during floods. When the bulk of the water recedes, some of these pools retain shallow water much like a vernal pool. Some of these pools along the margins of the high water line apparently act as vernal pools in supporting amphibian breeding if they are not flooded during the breeding period of a particular species. In addition to the true vernal pools, I will also report on these and other types of pools which showed evidence of or potentiial for supporting spring-breeding amphibians.

Methods

No one method will inventory the complete range of reptiles and amphibians occurring in an area. A combination of methods must be employed over a variety of seasons. I used eight herp-survey methods starting fieldwork with a flyover of the site on April 4, 1999 and finishing in the field on September 29, 1999. As much as possible, visits were timed to be during the optimal window of opportunity to locate all potential reptile and amphibian species in the area. A total of 15 days were spent at the site: four days in April, five in May, three in June, and three in September. All work was performed by the author working alone or supervising volunteers or interns. Almost all of the USAC land surrounding Union Village Dam was visited during some point in the survey.

The eight **herp-survey** methods used in this inventory are described below.

An active search is a concentrated effort in a predetermined area to locate reptiles and amphibians by raking leaf litter, looking under rocks and logs, looking within rotten logs or under any items, natural or unnatural, that provide moist and shady retreats during the day. Since this method can be used under almost any conditions during the field season, it is the method that I used most frequently. Active searches for reptiles were also performed under conditions in which they would be basking (cool sunny days in early spring or early fall).

A site check is a less localized form of active search that includes time spent searching for and traveling between the best micro-habitats. Site checks were frequently used while traveling to vernal pools or other target locations.

A night-time road search consists of driving roads at a speed of 10-15 mph with the vehicle window open to hear calling anurans, and with eyes on the road and road margins to see herptiles crossing the route. Road searches were performed when the surface of the road was wet or the night was relatively warm and humid. When herptiles were heard or spotted, the car was stopped, the organisms identified and counted, and their locations noted. The many small roads in and surrounding this property made this a useful survey method. All roads enclosed by Rte. 113 on the west, Tucker Hill Road on the north, Rte. 113 on the northeast, and Academy Road on the southeast were driven during periods of reptile and amphibian activity.

Salamander trapping involves the use of a series of unbaited minnow traps placed at selected locations in shallow water around the margin of potential breeding pools and swamps. It was used to locate caudates (salamanders) that bred in pools in the spring. It is a very effective method for locating amphibians but is only useful during a narrow window of time (April-May). I used these traps in most of the potential breeding sites that were located during the flyover.

Day-time road searches were performed in the fall on sunny days after cold nights. On these days many snakes can be found on the roads (alive and dead) that are otherwise difficult to locate. Snakes move to denning areas in the fall. If their movement causes them to cross roads they often hesitate on the roads to bring up their body temperatures. Unfortunately this often results in road kills but it also alerts the researcher to the presence of a species in an area. All roads near the dams were driven in the fall and road kills and live specimens were identified.

Turtle trapping was performed in the large beaver pond area, in the larger floodplain pools and along the main branch of the Ompompanoosic River above and below its confluence with the West Branch. Large 30 inch hoop traps with 1 inch mesh were baited with sardines and left for approximately 24 hours.

Interviews are useful in gathering important leads on areas where unusual or rare herptiles may be located now or were historically. I interviewed USAC employees at the site and the USAC naturalist by phone. I also talked to local landowners, hunters, fisherman, walkers, and state biologists.

Herp Atlas records As coordinator of the Herp Atlas Project all known records of Vermont herptiles current or historic are on a database on my computer. These records were accessed to locate all other records from the area (Appendix C).

Accidental discoveries are often made while employing a method not intended to locate that specific species or scouting or working at a site. Individuals located accidentally are identified as such in the data base printout.

Four methods were used to locate **vernal pools**.

A low-elevation flyover prior to leaf emergenge if timed properly can provide a very efficient survey of amphibian breeding locations (including vernal pools). Some of these locations are mapped on National Wetland Inventory Maps but many are too small or temporary to have been mapped. The timing and flight conditions of the April 4 flyover combined to provide excellent visibility. All but one very small vernal pool were located using this method and much of the area did not need to be surveyed on foot for vernal pools. Pools were photographed to aid in relocation from the ground. The original photographs are included with this report (Appendix G).

Interviews Vernal pools are frequently unobtrusive and/or remote and sometimes can be obscured from the air by softwoods. I asked for locations of wet areas when interviewing local residents and staff.

Maps USGS topo maps and National Wetland Inventory maps were used to locate spots that have the potential to have vernal pools. They also indicated some semipermanent and permanent breeding locations.

Ground surveys consisted of hiking those portions of the Union Village Dam property which were not visible from the air and visiting on foot those pools seen from the plane or mentioned in interviews.

Some of the vernal pools located in the spring contained direct evidence of breeding (egg masses or adults). The one additional vernal pool located in the fall was dry. Hence species usage can only be inferred. Since vernal pools diminish in size over the course of

the year, the three measurements included in this report are an estimate of the extent of the water in the pool if it was at mean spring levels (early May). The three measurements are a rough estimate of the greatest length, greatest width, and depth at the deepest point.

Some of the vernal or ephemeral pools located were filling a man-made or enhanced depression or were filled by some alteration of drainage. A few of these sites were mapped. Those that fit the strict definition of a vernal pool and supported amphibian breeding are clearly labeled (Figure 1).

Results: reptiles and amphibians located, basic ecology, relative abundance, and ranks

Twenty one species of herptile were located in or near the project area: six species of salamander, seven species of frog (& toad), three species of turtle, and five species of snake. All of these sightings, with dates, documentation status, state heritage ranks, and author of the field reports are listed in Appendix A. No state or federally listed species were located. All herptiles located or reported, their relative abundance, and status are summarized in Table 1.

Amphibians as a group were not particularly abundant in the project area. Some such as *Plethodon cinereus* (Redback salamander) are sensitive to flooding. Many amphibians require a deep litter layer and well-shaded, moist, mature, hardwoods for part of their life cycle. Others are sensitive to fragmentation. Many of the woodlands surrounding breeding sites in this area were highly fragmented by roads, old fields, lawn, or recreational areas. Large areas of well drained soil were also less than ideal for amphibian moisture requirements.

Six **caudate** (salamander) species were located in the project area. *Ambystoma maculatum* (Spotted Salamander) adults and egg masses were located thirteen times. This species breeds in some of the vernal pools, and beaver dams of the area as well as some of the pools along the edge of the floodplain. *Eurycea bislineata* (Northern Two-lined Salamander) was also located 13 times. This species' habitat is along the margins of small streams and in or near seepage areas. *Notophthalmus viridescens* (Eastern Newt) were located eleven times. Adults were occasionally seen in still water and the Red eft stage was occasionally located in the woods. *Desmognathus fuscus* (Dusky Salamander) was located five times with a maximum number of three at one site. It was sometimes found with *E. bislineata* but it was also found in shaded seepage areas in the woods. *Plethodon cinereus* (Redback Salamander) was located only four times. This is the only salamander species in Vermont that does not require standing or running water. Hence it can be dispersed widely in woods well away from pools, ponds, and streams. Very few of this normally abundant species were located. They are intolerant of flooding. Yet they were missing even above the usual high-water line. It may be a result of the highly fragmented woods, shallow leaf litter, substrate type, or relative youth of the second-growth hardwoods. *Gyrinophilus porphyriticus* (Spring Salamander) is a stream salamander that requires well oxygenated, cold, clear, clean water. I was able to locate a single specimen of this species in the small brook draining into the large beaver dam complex along the west bank of the Main Branch of the Ompompanoosic.

None of these salamanders are rare in Vermont or the US. Dusky salamander and Spring salamander are ranked as S4 species. The other four (Spotted, Eastern newt, Redback, and Northern two-lined) are all S5 species in Vermont and G5 globally. Appendix E contains the 1999 list of all Vermont herptile species and their heritage ranks.

Seven species of **anurans** (frogs and toads) were located in the project areas. *Rana sylvatica* (Wood Frog) was located 32 times as egg masses, tadpoles, or adults and sometimes in good numbers. Like the spotted salamander, it breeds in vernal pools, beaver dams, and in a couple of the pools along the margin of the floodplain. After breeding, adults return to the woods. *Rana clamitans* (Green Frog) was located 13 times

Table 1. Reptiles and amphibians found on or near the US Army Corps of Engineers' Property at Union Village Dam in Thetford, VT during 1999.

Species	Common name	# of reports	State rank	Global rank
Caudates	**Salamanders**			
Ambystoma maculatum	Spotted Salamander	13	S5	G5
Eurycea bislineata	N. Two-lined Salamander	13	S5	G5
Notophthalmus viridescens	Eastern Newt	11	S5	G5
Desmognathus fuscus	Dusky Salamander	5	S4	G5
Plethodon cinereus	N. Redback Salamander	4	S5	G5
Gyrinophilus porphyriticus	Spring Salamander	1	S4	G5
Anurans	**Frogs and toads**			
Rana sylvatica	Wood Frog	32	S5	G5
Rana clamitans	Green Frog	13	S5	G5
Pseudacris crucifer	Spring Peeper	10	S5	G5
Bufo americanus	American Toad	6	S5	G5
Hyla versicolor	Gray Tree Frog	6	S5	G5
Rana catesbeiana	Bullfrog	5	S5	G5
Rana palustris	Pickerel Frog	4	S4	G5
Testudines	**Turtles**			
Chrysemys picta	Painted Turtle	7	S5	G5
Chelydra serpentina	Snapping Turtle	4	S5	G5
Clemmys insculpta	Wood Turtle	2	SC-S3	G5
Serpentes	**Snakes**			
Thamnophis sirtalis	Common Garter Snake	8	S5	G5
Lampropeltis triangulum	Milk Snake	2	S5	G5
Storeria occipitomaculata	Redbelly snake	1	S5	G5
Diadophis punctatus	Ringneck Snake	1	S4	G5
Liochlorophis vernalis	Smooth Green Snake	1	S4	G5

Table 2. Reptiles in the Vermont Herp Database that are reported from surrounding towns but were not found during the survey in the project areas.

Species	Common name	Towns	Likelihood
Ambystoma jeffersonianum	Jefferson Salamander	Norwich	Unlikely
		Strafford	
Rana pipiens	N. Leopard Frog	Norwich	Unlikely
		Strafford	
Storeria dekayi	Brown Snake	Strafford	Possible

in generally small numbers primarily in beaver ponds and isolated floodplain pools but also in a couple of the vernal pools. It breeds in still permanent water with surrounding vegetation but travels widely as long as it can stay moist. *Pseudacris crucifer* (Spring Peeper) was recorded 10 times. This species is more often heard then seen. Some reports of this species are of choruses which may include scores of individuals. It breeds in a variety of still waters from ditches to beaver dams. Total numbers were not impressive. *Bufo americanus* (American Toad) was also located 6 times. Sometimes calling or occasionally two or three adults in a search area. At other Army Corps sites, this is one of the few species that I have seen breed in the floodplain after the spring flood water subsided. *Hyla crucifer* (Gray Treefrog) was located six times. It is an arboreal species and hence it is very difficult to find. It is most easily located by call during hot humid June and July nights. It is probably under-reported here as a result. It breeds in permanent water containing standing vegetation. *Rana catesbeiana* (Bullfrog) was heard or seen five times. This species requires permanent still water with vegetated margins. *Rana palustris* (Pickerel Frog) was located four times. There appears to be appropriate habitat for this species, yet relatively few were found. This species likes dense annual vegetation near clean permanent water. The Pickerel Frog state rank was recently changed (January 1997) to an S4. All other anuran (frog) species located are listed as S5 species in Vermont and G5 globally.

Reptiles are very rarely as abundant as amphibians in Vermont. As expected they were located much less frequently. Two species of turtle were found in the project area. *Chrysemys picta* (Painted Turtle) was seen seven times. Despite trapping efforts elsewhere, they were found only in the beaver pond area mentioned previously. This species prefers still permanent water bodies with soft bottoms. *Chelydra serpentina* (Snapping Turtle) was located four times in the Beaver ponds and in floodplain pools. Since this species is almost entirely aquatic, they are probably underreported. This turtle is rugged and adaptable. It inhabits all types of permanent water. Both of these are S5 species in Vermont and G5 globally. *Clemmys insculpta* (Wood turtle) was well described by a resident who walks on the Army Corps property regularly. She caught one and had it identified over the phone by the staff at the Vermont Institute of Natural Science. I was unable to find any of the species myself on the property but did manage to locate a single small specimen upstream from the dam property. It was crossing Rte. 132 where Abbott Brook enters the West Branch of the Ompompanoosic River near Miller Pond Rd. The Wood turtle is an S3 species in Vermont. It has been collected near this dam from along the Ompompanoosic River. That specimen is in the American Museum of Natural History in NYC. It has been reported as recently as 1985 from Norwich and 1990 from West Fairlee. Wood turtles are known to travel over a mile to reach good nesting locations. It seems probable that small numbers continue to use this Army Corps property.

Five species of snake were confirmed in the project area. *Thamnophis sirtalis* (Common Garter Snake) was located eight times. This species is by far the most abundant and adaptable snake species in Vermont and hence has a state rank of S5. Two *Lampropeltis triangulum* (Milk Snake) were found on the property. This species is also ranked as an S5 but is no where near as widespread and abundant as the Common Garter Snake. A single *Diadophis punctatis* (Ringneck Snake) was located at the base of the rock slope at the eastern edge of the top of the dam. This is a secretive S4 species. A single *Liochlorophis vernalis* (Smooth Green Snake) was located along Rte. 132 on the western border of the property. This S4 species is quite unusual in the state. It prefers upland pastures and overgrown fields. A single adult *Storeria occipitomaculata* (Redbelly snake - S5) was found near the open fields along the east side of the main branch of the river. Two additional skins of the same genus were located but they may have been from either this or a different closely related species. This is a secretive mixed woodland snake.

Species reliably reported from surrounding towns but not located during the survey

Reliable reports of three additional species are found in the Vermont Herp Database for the towns immediately surrounding Thetford (Table 2 & Appendix B): Jefferson Salamander (*Ambystoma jeffersonianum* - S2), Northern Leopard Frog (*Rana pipiens* - S4), and Brown Snake (*Storeria dekayi* - S4). None of these species were located during the survey. If a significant population of Jefferson Salamanders were within the confines of the property I should have seen their egg-masses. I think it unlikely that they are breeding on the property. Still, since they are an S2 species, staff should be on the lookout for them. They are a large (6-7 inch) heavy-bodied, solid-color, grayish brown, salamander that might be encountered crossing a road on some rainy spring evening. If it were located, an effort should be made to locate its breeding site and protect and manage the breeding site along with the surrounding woodlands. Northern Leopard Frogs are explosive breeders. The best potential overwintering habitat for them would seem to be the beaver pond area. They should have been easily located if in the area. I think it is unlikely that they are. It is possible however that a small population of Northern Brown Snakes could be on the property. I found two shed skins from this genus. However, I also found an adult Redbelly Snake which is in the same genus and may have been the source of the skins.

A list of all species ever reported from either Orange or Windsor Counties but not found during this survey (including unverified records), is included in Appendix C. Three of them are S1 species in Vermont. There is no evidence that they use the Army Corps lands surveyed now or that they have in the past but local staff should be aware of their significance if they ever were sighted. Timber rattlesnake, (*Crotalus horridus*) has been reliably reported from both Springfield and Windsor with a couple unverified reports from as nearby as Sharon. Fowler's Toad (*Bufo fowleri*) was reported from White River Junction in 1983.. It is the only record of this species from Windsor County. I suspect its distribution is limited to the Connecticut River Floodplain. The Black Racer (*Coluber constrictor*) is Vermont's rarest snake. One historic record (not well documented) exists from Royalton in 1911 and plausible but unverified reports come from Hartland, Royalton and Corinth. If it continues to exist in this state at all it would most likely be found in overgrown fields and along warm rocky ridges adjacent to the southern Connecticut River Valley.

It is not possible to prove the absence of rare species. It is still possible that other species exist in low numbers within the project area. However, given the distribution and amount of field effort combined with interviews of individuals who have spent a great deal of time in the area it is very unlikely that species not listed here have viable populations within the project areas.

Additional information on the field marks, habitat, and natural history of all Vermont amphibians is contained in Appendix D.

Vernal Pools

Six temporary pools showed evidence of amphibian spring-breeding and fit the definition of vernal pools. In addition amphibian breeding was seen in the beaver ponds and some of the large floodplain pools. Sixteen locations are shown in Figure 1. Not all of them are classic vernal pools nor did they all show evidence of amphibian use. Table 3 gives a brief description of pool type, significance, size, origin, and includes notes on the amphibians which were found using the pools. The numbers are keyed to those on my map (Figure 1). No evidence of rare, threatened, or endangered amphibians was found in any of the pools.

The floodplains of Union Village Dam contain some low areas that trap and hold water after flooding. The largest and most permanent of these are clearly shown on USGS topographical maps or National Wetlands Inventory maps. However, none of the

vernal pools I identified on my maps are on either of the above two map types. In addition, some of the smaller pools in the floodplains are not shown. If the floodplain was filled at the normal time of spring breeding for amphibians (April), these depressions would not be available to them. Those that are located well out in the floodplain would only rarely be available to spring breeders, although they could be breeding sites for summer breeders (the ones that do not use vernal pools). Some of the pools along the margins of the floodplain would be available more frequently. However, even if the flood water withdraws early enough for amphibians to reach some of these sites, the flooding distributes predators such as fish into some of these little pools. These predators would have a negative impact on the breeding success of vernal pool breeders at these sites. I located spring breeding amphibians in even some of the larger depressions along the margin of the floodplains perhaps due to the relatively low water level this spring.

Although not vernal pools, beaver dams are also important amphibian breeding sites. The vernal-pool breeding species found in this project area also breed in beaver ponds with adequate sub-aquatic cover for the tadpoles, and adequate surrounding woodlands for the adults. As beaver ponds age and break, vernal pools may be left.

A few of the pools mapped were too ephemeral this year to support amphibian breeding. However, in wetter springs they may be able to support limited breeding, hence they were shown in Figure 1.

Pools VP1,2,3,4,5, and VP11 fit the definition of vernal pool and showed evidence of spring amphibian breeding. They are marked with an asterisk in Table 3, were the only pools marked on the composite aerial photos, and are circled on the topo map (Figure 1). Pools VP6,7,8 and EP9 & 10 were not productive this year but may be lightly to moderately productive in a wet year. In any year they are not as significant as the first six. VP12 is tiny but deep enough to support very limited breeding. I discovered it too late in the year to know if it did. Floodplain pools FP 13 & 14 did support amphibian breeding this year (but are not typical vernal pools). I suspect they were used since there was not significant flooding this spring and they had access to the site in early spring. The oxbow FP15 may also support breeding in wet years and could fit the definition of a vernal pool now that it is largely isolated from the river but it was entirely dry by the time of my visit in June. One of the most productive areas for all reptiles and amphibians was the beaver pond complex (BD16). The margins of these ponds will support species typical of vernal pools while the deeper water sections support the late and permanent water breeders.

Conservation (herps)

The only S3 species that is known to use the area is *C. insculpta* (Wood turtle). This species is far more terrestrial than the other two local turtle species. It wanders territories that extend along river valleys and up to a few hundred meters away from the river. It was not located by me on the Army Corps property but it was reliable reported on the property and I found it this summer just upstream. Other older records from the area support both these records. All of the project area should be considered potential habitat. In a large area such as this with an apparently small population of *C. insculpta* it would be necessary to attach radio transmitters to the adults and monitor their activities in order to locate significant feeding, overwintering, and nesting areas.

C. insculpta are excellent climbers but must find the dams a serious obstacle (although not insurmountable as evidenced by M. Toni's observation of a Wood turtle on top of Townshend Dam). The large gaps between the rocks used in the construction of sections of the dam may act as traps. The wooded, or grassy areas should not be a barrier. Heavily traveled roads are a serious threat to this species. Many of my reports from around the state are of specimens killed in roads. Commercial and personal collection are also a threat. Mowing could also cause mortality depending on the timing of the cut and the height of the mower blade. If mowing were done only after the ground

Table 3. Descriptive information on selected pools found in the project area. Vernal pools known to support spring-breeding amphibians are starred.

Vernal pool — Union Village Dam — Vernal Pool 4/15/99 - 1 on field map

VP1* 4/15/99 — 4m x 3m x 20 cm

In open overflow at base of west end of the main dam below flagpole and circular drive.
Near trail. Cattails. Low numbers, three species.

R. clamitans, R. sylvatica, A. maculatum

Vernal pool — Union Village Dam — Vernal Pool 4/15/99 - 2 on field map

VP2* 4/15/99 — 40m x 8m x 100 cm

In wooded ravine north of Rte. 132. pull off with view of dam.
North of pine plantation. Approximately 100m down ravine from Rte. 132.
Looks classic but low productivity, two species.
R. sylvatica, R. clamitans

Vernal pool — Union Village Dam — Vernal Pool 4/15/99 - 3 on field map

VP3* 4/15/99 — 80m x 20m x 50 cm

Two connected pools in alder swamp roughly 60m southwest of Tucker Hill Road, east of West Branch.
Classic looking, highly productive of Wood Frogs, moderate numbers of Spotted's.

R. sylvatica, A. maculatum

Vernal pool — Union Village Dam — Vernal Pool 4/15/99 - 4 on field map

VP4* 4/15/99 — 20m by 20m area of grassy tussocks with small 1- 2 m openings 30 cm deep

Approximately 50 m northwest of 4/15/99-3. Grassy tussocks in an alder swamp fed by a seepage.
Roughly 50m southwest of Tucker Hill Road, east of West Branch.
Loud choruses of peepers, moderate numbers of other two species.
R. sylvatica, A. maculatum, P. crucifer

Vernal pool — Union Village Dam — Vernal Pool 4/15/99 -5 on field map

VP5* 4/15/99 — 3m x 4m 30 cm

In open grassy floodplain near old foundations. West of West Branch, roughly 100 m east of Rte. 132.
Just east of an old access road. Good production of Wood Frogs, small numbers of Spotteds.

R. sylvatica, A. maculatum

Vernal pool — Union Village Dam — Vernal Pool 4/15/99 -6 on field map

VP6 4/15/99 — 60m x 5m x 20 cm

Roughly 70 m further south in the same open grassy field as 4/15/99-5. At base of slope just east of the access road.
Deepest sections under a couple white pines. Part of an old stream channel. Not productive, one Wood frog egg mass.
More ephemeral that #5, dried quickly.
R. sylvatica

Vernal pool — Union Village Dam — Vernal Pool 4/15/99 -7 on field map

VP7 4/15/99 — 3m x 4m x 30 cm

Roughly 40 m northwest and just accross the access road from 4/15/99-5.
Small grass-filled depression next to and just west of the access road.
Not productive.
R. sylvatica

Ephemeral pool — Union Village Dam — Vernal Pool 4/15/99-8 on field map

VP8 4/15/99 — 3m x 5m x 10 cm

In floodplain shrubs along Main Branch. Just 5 m west of the access road.
Across Main Branch from beaver pond area.
No productivity seen. Too ephemeral.

Ephemeral pools — Union Village Dam — Ephemeral Pools 4/15/99-9/10 on field map

EP9.10 5/6/99

3m x 5m x 10 cm
Next to and just west of the Main Branch access road. South of the beaver pond area but north of the confluence of the two branches.
Wet brushy area on opposite side of the road was too shallow to warrant trapping.
Nothing found, but may provide breeding in wetter years.

Vernal pool — Union Village Dam — Vernal Pool 4/15/99 - 11 on field map

VP11* 4/16/99 7m x 4m x 25 cm

In floodplain shrubs roughly 30 m west of the Main Branch access road, east of the Main Branch, north of the confluence of the two river branches.
Surprisingly productive for such a small and open pool.
A. maculatum, R. sylvatica

Vernal pool — Union Village Dam — Vernal Pool 9/28/99 - 1 on field map

VP12 9/28/99 2m x 2m x 40 cm

In pine and hemlock, within flood plain just east of snowmobile trail west of the West Branch.
Northwest of the access road bridge across the West Branch in the next small wooded floodplain.
Despite its tiny size, this relatively deep depression in the woods may hold water long enough for amphibian breeding.
Too late in the season to observe signs of breeding.

Floodplain pools — Union Village Dam — Flood Plain Pool 5/6/99 - 2&3 on field map

FP13.14 5/6/99 #2 not estimated but much smaller and shallower than #3, #3 100m x 70m x 2m

Mucky-bottomed floodplain pools in shrubs east of the main branch below the confluence and west of the access road.

#2 A. maculatum egg-masses, #3 B. americanus calling, C. serpentina

Floodplain pool — Union Village Dam — Floodplain pool 6/23/99-1 on field map

FP15 6/23/99 Roughly 100m x 5m x 40 cm

Old oxbow filled with sedges. Visible on both USGS topo and NWI maps.
Roughly 100 m west of Rte. 113, and north of the Tucker Hill Road junction.
Visited too late in the season to determine amphibian usage. Already dry as a result of the drought.
Too late in the season to evaluate spring breeding.

Beaver ponds — Union Village Dam — Beaver Dams 4/15/99-BD on field map

BD16 4/15/99

Large complex of beaver ponds west of the Main Branch, north of the footbridge. Very productive for a wide variety of species.

C. picta, C. serpentina, R. clamitans, R. catesbeiana, H. versicolor, P. crucifer, N. viridescens, possibly other spring breeders.

freezes in the fall, mortality would be minimized. The higher the mower blades the better. A minimum height of six inches should be maintained. Increased recreational use of the project areas would also provide an increased threat to this species. Studies have shown a decrease in populations of this species with increased recreational pressure (Garber and Burger, 1995). Other than mortality as a result of increased traffic and recreational vehicles, the implication is that the increased occurrence of accidental meetings of terrestrial turtle (very cute) and human often results in a kidnapped turtle which is permanently removed from the breeding population. This turtle does not breed until it reaches an age of ~14 years (Ernst et al, 1994). It is a long lived, low reproductive capacity species which can not tolerate the removal of those few adults that have managed to make it to breeding age. Increased egg predation from raccoons and skunks also may be limiting populations. If nests are found, covering the nest with wire mesh so that they can not be dug up can prevent egg mortality but these coverings need to be checked regularly or designed so that small turtles can escape. Public and camper education, keeping roads and traffic to a minimum, maintaining sections without trails, and the use of underpasses when necessary could all help this species survive.

Most of the woodland species of reptiles and amphibians were located above the high water line of the dams, suggesting that they are intolerant of flooding. More recent high water lines could be determined by the flotsam deposited in the woods. I have seen this intolerance to flooding before, particularly with *P. cinereus* (Redback salamander). However other species such as *E. bislineata* (N. two-lined salamander) and *D. fuscus* (Dusky salamander) were not located below the high water line in the project areas. Frogs and spring breeding salamanders did migrate into the margins of the floodplain to breed and *C. serpentina* (Snapping turtle) and *C. picta* (Painted turtle) were found in the floodplains also.

General recommendations for the maintenance of reptile and amphibian habitat is included in the handout Forest Management Practices to Minimize the Negative Impacts on Vermont Reptiles and Amphibians. I have included a copy (Appendix F).

Conservation (vernal pools)

Vernal pools are the result of a fine balance between the amount of water received and the rate at which it is lost. If they are exposed to more sunlight than they normally receive, they may evaporate too fast to provide habitat through metamorphosis in June or July. Hence it is important that these pools remain shaded and that the drainage is not altered in such a way as to prevent them from receiving and/or holding as much run-off. A minimum 30 m buffer of uncut trees should be left to conserve shade. However, it should be kept in mind that the amphibians breeding in these pools may be coming from as far away as 400 meters. deMaynadier and Hunter (1995) recommend that no more than 25% of the basal area should be cut in a 100m 2nd-tier buffer that extends beyond the no-cut zone. Heavy equipment should be kept out of the pools and they should not be filled with debris. If possible they should not be flooded by backwater from the dams. This could introduce predators, or prevent access to the breeding adults.

Access to the pools is a concern, if heavily traveled roads are built or already exist between wintering areas and breeding pools, scores of amphibians will be killed on warm rainy nights in the spring as they migrate to the pools to breed. If roads can be closed during these periods (April-May nights) it will minimize road kills of breeding adults. Although young will still need to leave the ponds in June through August. Properly designed amphibian tunnels built under roads can guide young and adult amphibians, reptiles, and small mammals under roads. These are used heavily in Europe but have only begun to be used in the US (Langton, 1989). They are a worthwhile investment in wildlife.

Amphibian breeding traps can result when pools are created in gravel pits or road beds that hold water long enough to entice amphibians to breed but not long enough for

the young to metamorphose. Even if these pools hold water through the time of metamorphosis, some of them are too frequently disturbed by vehicles to produce metamorphs. The drainage of man-made pools that are frequently disturbed (road beds) should be altered so that they do not gather any water in the spring. They could also be relocated to areas that are not disturbed. If so, care should be taken to make sure they are deep enough to hold water through July of most years (>50cm).

Amphibians absorb water and any substance that is dissolved in it directly through their skin. The long-term affects of many chemicals (herbicides, pesticides, fungicides, etc.) have not been tested on amphibians. Many others have been shown to be toxic (Power et al, 1989). Alternatives to chemicals should be sought to protect amphibian species.

Other species of interest

Other species (not reptiles or amphibians) identified while in the field are written in the copies of my field notes. Those that were most unusual are listed here.

Rusty blackbird	Beaver pond complex	5/13
Black-billed cuckoo	Burnt-over fields east of Main Branch access road	6/24

Technical literature cited or useful

Brown, W.S. 1993. Biology, status, and management of the timber rattlesnake (*Crotalus horridus*): a guide for conservation, Herpetological Circular No. 22. Society for the Study of Reptiles and Amphibians 78 pp.

deMaynadier, P. and M. Hunter. 1995. The relationship between forest management and amphibian ecology: a review of the North American literature. Environmental Reviews 3:230-261.

Ernst, C.H., R.W. Barbour, and J.E. Lovich. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington D.C. 578 pp.

Garber, S.D. and J. Burger. 1995. A 20-yr study documenting the relationship between turtle decline and human recreation. Ecological Applications, 5(4) pp. 1151-1162.

Power, T., Clark, K.L., Harfenist, A., and D.B. Peakall. 1989. A review and evaluation of the amphibian toxicological literature, Technical Report No. 61, Canadian Wildlife Service, Headquarters 222 pp.

Langton, T.E., 1989. Amphibians and Roads. Proceedings of the Toad Tunnel Conference, Rendsburg, Federal Republic of Germany, 7-8 January, 1989. ACO Polymer Products, Ltd. Shefford U.K. 202 pp.

Other Useful Sources of Information on New England Reptiles and Amphibians

Identification. A few good field guides to reptiles and amphibians exist. These help you identify herptiles but do not give you life history information. One that is easy to find, and up to date is:

Conant, R., and J.T. Collins. 1998. A field guide to reptiles and amphibians of Eastern and Central North America. Third Edition, expanded, Houghton Mifflin Company, Boston Massachusetts 616 pp.

Natural History. These guides focus less on identification and more on natural history, local distribution, and conservation.

DeGraaf, R.M., and D.D. Rudis. 1983. Amphibians and reptiles of New England. The University of Massachusetts Press, Amherst, Massachusetts 85 pp.

Harding, J.H. 1997. Amphibians and reptiles of the Great Lakes Region. The University of Michigan Press, Ann Arbor, Michigan 378 pp. (Lake Champlain is part of the Great Lakes Drainage so we share most of the same species.)

Hunter, M.L., A. Calhoun, and M. McCullough (eds.). 1999. Maine amphibians and reptiles. The University of Maine Press, Orono, Maine 272 pp. (This edition includes a CD of local frog calls. Call 207-581-1408 to order.)

Klemens, M.K. 1993. Amphibians and reptiles of Connecticut and adjacent regions. State Geological and Natural History Survey of Connecticut, Bulletin No. 112 318 pp.
(call 203-566-7719 to order)

Tyning, T.F. 1990. A guide to amphibians and reptiles. Little, Brown and Company. Boston Massachusetts 400 pp.

Calls. A very useful tape to help you learn the calls of frogs and toads is:

Eliot, L. 1992. The calls of frogs and toads; Eastern and Central North America. Nature Sound Studio. Ithaca New York.
(call 1-800-336-5666 to order)

Websites. Many useful sites exist. Some provide more reliable information than others. A few reliable sites to get you started:

North American Amphibian Monitoring Program (NAAMP).
http://www.im.nbs.gov/amphibs.html

North American Reporting Center for Amphibian Malformations (NARCAM).
http://www.npsc.nbs.gov/narcam/

Society for the Study of Amphibians and Reptiles (SSAR).
http://falcon.cc.ukans.edu/~gpisani/SSAR.html

The Snakes of Massachusetts (a useful identification key).
http://klaatu.oit.umass.edu/umext/snake/

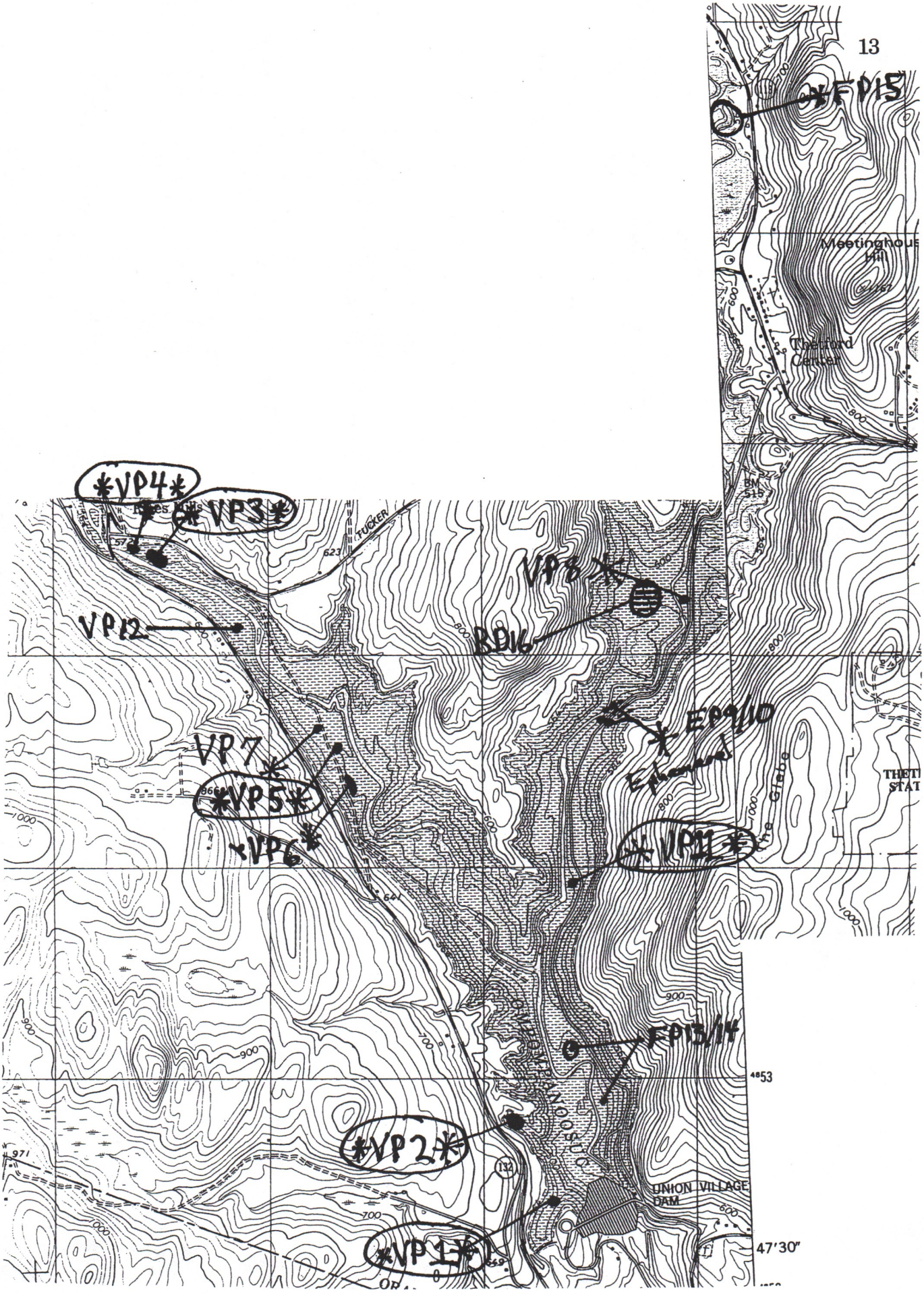

Figure 1. Locations of vernal pools within the Union Village Dam project area.

Appendix A

All Records of Reptiles and Amphibians Found During the 1999 Survey of Union Village Dam

Sorted by Class, Order, and Common Name

Eastern newt	S5	Thetford	4/16/99	Photo	J. Andrews
Eastern newt	S5	Thetford	4/16/99	Sight	J. Andrews
Eastern newt	S5	Thetford	5/6/99	Sight	J. Andrews
Eastern newt	S5	Thetford	5/7/99	Photo	J. Andrews
Eastern newt	S5	Thetford	5/12/99	Sight	J. Andrews
Eastern newt	S5	Thetford	5/12/99	Sight	J. Andrews
Eastern newt	S5	Thetford	5/13/99	Sight	J. Andrews
Eastern newt	S5	Thetford	6/23/99	Sight	J. Andrews
Eastern newt	S5	Thetford	6/24/99	Sight	J. Andrews
Eastern newt	S5	Thetford	9/27/99	Sight	J. Andrews
Northern dusky salamander	S4	Thetford	5/6/99	Photo	J. Andrews
Northern dusky salamander	S4	Thetford	5/13/99	Sight	J. Andrews
Northern dusky salamander	S4	Thetford	5/13/99	Sight	J. Andrews
Northern dusky salamander	S4	Thetford	6/23/99	Sight	J. Andrews
Northern dusky salamander	S4	Thetford	6/23/99	Sight	J. Andrews
Northern redback salamander	S5	Thetford	5/13/99	Photo	J. Andrews
Northern redback salamander	S5	Thetford	5/13/99	Photo	J. Andrews
Northern redback salamander	S5	Thetford	6/23/99	Sight	J. Andrews
Northern redback salamander	S5	Thetford	9/29/99	Sight	J. Andrews
Northern two-lined salamander	S5	Thetford	5/6/99	Photo	J. Andrews
Northern two-lined salamander	S5	Thetford	5/7/99	Sight	J. Andrews
Northern two-lined salamander	S5	Thetford	5/7/99	Sight	J. Andrews
Northern two-lined salamander	S5	Thetford	5/7/99	Sight	J. Andrews
Northern two-lined salamander	S5	Thetford	5/7/99	Sight	J. Andrews
Northern two-lined salamander	S5	Thetford	5/12/99	Sight	J. Andrews
Northern two-lined salamander	S5	Thetford	5/12/99	Sight	J. Andrews
Northern two-lined salamander	S5	Thetford	5/12/99	Sight	J. Andrews
Northern two-lined salamander	S5	Thetford	5/13/99	Sight	J. Andrews
Northern two-lined salamander	S5	Thetford	5/13/99	Sight	J. Andrews
Northern two-lined salamander	S5	Thetford	5/13/99	Sight	J. Andrews
Northern two-lined salamander	S5	Thetford	5/13/99	Sight	J. Andrews
Northern two-lined salamander	S5	Thetford	9/28/99	Sight	J. Andrews
Spotted salamander	S5	Thetford	4/15/99	Sight	J. Andrews
Spotted salamander	S5	Thetford	4/16/99	Sight	J. Andrews
Spotted salamander	S5	Thetford	4/16/99	Sight	J. Andrews
Spotted salamander	S5	Thetford	4/17/99	Sight	J. Andrews
Spotted salamander	S5	Thetford	4/17/99	Sight	J. Andrews
Spotted salamander	S5	Thetford	5/6/99	Sight	J. Andrews
Spotted salamander	S5	Thetford	5/6/99	Sight	J. Andrews
Spotted salamander	S5	Thetford	5/6/99	Sight	J. Andrews
Spotted salamander	S5	Thetford	5/6/99	Sight	J. Andrews
Spotted salamander	S5	Thetford	5/6/99	Sight	J. Andrews
Spotted salamander	S5	Thetford	5/7/99	Sight	J. Andrews
Spotted salamander	S5	Thetford	5/13/99	Sight	J. Andrews
Spring salamander	S4	Thetford	5/13/99	Sight	J. Andrews

American toad	S5	Thetford	5/6/99	Heard	J. Andrews
American toad	S5	Thetford	5/7/99	Photo	J. Andrews
American toad	S5	Thetford	6/22/99	Sight	J. Andrews
American toad	S5	Thetford	6/22/99	Heard	J. Andrews
American toad	S5	Thetford	6/23/99	Sight	J. Andrews
American toad	S5	Thetford	6/23/99	Sight	J. Andrews
Bullfrog	S5	Thetford	5/6/99	Heard	J. Andrews
Bullfrog	S5	Thetford	5/13/99	Heard	J. Andrews
Bullfrog	S5	Thetford	6/22/99	Heard	J. Andrews
Bullfrog	S5	Thetford	6/23/99	Heard	J. Andrews
Bullfrog	S5	Thetford	9/27/99	Sight	J. Andrews
Gray tree frog	S5	Thetford	5/6/99	Heard	J. Andrews
Gray tree frog	S5	Thetford	5/7/99	Heard	J. Andrews
Gray tree frog	S5	Thetford	6/22/99	Heard	J. Andrews
Gray tree frog	S5	Thetford	6/23/99	Heard	J. Andrews
Gray tree frog	S5	Thetford	6/23/99	Heard	J. Andrews
Green frog	S5	Thetford	4/15/99	Sight	J. Andrews
Green frog	S5	Thetford	4/15/99	Sight	J. Andrews
Green frog	S5	Thetford	4/16/99	Sight	J. Andrews
Green frog	S5	Thetford	5/6/99	Sight	J. Andrews
Green frog	S5	Thetford	5/7/99	Sight	J. Andrews
Green frog	S5	Thetford	5/7/99	Photo	J. Andrews
Green frog	S5	Thetford	6/22/99	Heard	J. Andrews
Green frog	S5	Thetford	6/22/99	Sight	J. Andrews
Green frog	S5	Thetford	6/23/99	Sight	J. Andrews
Green frog	S5	Thetford	6/23/99	Heard	J. Andrews
Green frog	S5	Thetford	9/27/99	Sight	J. Andrews
Green frog	S5	Thetford	9/28/99	Sight	J. Andrews
Green frog	S5	Thetford	9/28/99	Sight	J. Andrews
Pickerel frog	S4	Thetford	5/6/99	Sight	J. Andrews
Pickerel frog	S4	Thetford	5/7/99	Heard	J. Andrews
Pickerel frog	S4	Thetford	6/23/99	Sight	J. Andrews
Pickerel frog	S4	Thetford	6/24/99	Sight	J. Andrews
Spring peeper	S5	Thetford	4/15/99	Heard	J. Andrews
Spring peeper	S5	Thetford	4/15/99	Sight	J. Andrews
Spring peeper	S5	Thetford	4/16/99	Heard	J. Andrews
Spring peeper	S5	Thetford	4/16/99	Photo	J. Andrews
Spring peeper	S5	Thetford	4/17/99	Heard	J. Andrews
Spring peeper	S5	Thetford	5/6/99	Heard	J. Andrews
Spring peeper	S5	Thetford	5/6/99	Heard	J. Andrews
Spring peeper	S5	Thetford	5/7/99	Heard	J. Andrews
Spring peeper	S5	Thetford	5/13/99	Heard	J. Andrews
Wood frog	S5	Thetford	4/15/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/15/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/15/99	Heard	J. Andrews
Wood frog	S5	Thetford	4/15/99	Sight	J. Andrews

Wood frog	S5	Thetford	4/15/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/15/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/15/99	Heard	J. Andrews
Wood frog	S5	Thetford	4/15/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/15/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/15/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/15/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/15/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/15/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/16/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/16/99	Photo	J. Andrews
Wood frog	S5	Thetford	4/16/99	Photo	J. Andrews
Wood frog	S5	Thetford	4/16/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/16/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/16/99	Heard	J. Andrews
Wood frog	S5	Thetford	4/16/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/17/99	Heard	J. Andrews
Wood frog	S5	Thetford	4/17/99	Heard	J. Andrews
Wood frog	S5	Thetford	4/17/99	Sight	J. Andrews
Wood frog	S5	Thetford	4/17/99	Sight	J. Andrews
Wood frog	S5	Thetford	5/6/99	Sight	J. Andrews
Wood frog	S5	Thetford	5/6/99	Sight	J. Andrews
Wood frog	S5	Thetford	5/6/99	Sight	J. Andrews
Wood frog	S5	Thetford	5/6/99	Sight	J. Andrews
Wood frog	S5	Thetford	5/6/99	Sight	J. Andrews
Wood frog	S5	Thetford	6/22/99	Sight	J. Andrews
Wood frog	S5	Thetford	6/23/99	Photo	J. Andrews
Wood frog	S5	Thetford	6/23/99	Sight	J. Andrews
Storeria sp.		Thetford	6/24/99	Sight	J. Andrews
Storeria sp.		Thetford	9/28/99	Sight	J. Andrews
Common garter snake	S5	Thetford	5/6/99	Photo	J. Andrews
Common garter snake	S5	Thetford	5/13/99	Sight	J. Andrews
Common garter snake	S5	Thetford	6/23/99	Sight	J. Andrews
Common garter snake	S5	Thetford	6/24/99	Sight	J. Andrews
Common garter snake	S5	Thetford	6/24/99	Sight	J. Andrews
Common garter snake	S5	Thetford	9/28/99	Sight	J. Andrews
Common garter snake	S5	Thetford	9/28/99	Sight	J. Andrews
Common garter snake	S5	Thetford	9/29/99	Sight	J. Andrews
Milk snake	S5	Thetford	6/23/99	Photo	J. Andrews
Milk snake	S5	Thetford	9/28/99	Sight	J. Andrews
Redbelly snake	S5	Thetford	9/27/99	Photo	J. Andrews
Ringneck snake	S4	Thetford	6/24/99	Photo	J. Andrews
Smooth green snake	S4	Thetford	9/29/99	Photo	J. Andrews
Common snapping turtle	S5	Thetford	5/7/99	Photo	J. Andrews
Common snapping turtle	S5	Thetford	5/7/99	Photo	J. Andrews
Common snapping turtle	S5	Thetford	6/23/99	Sight	J. Andrews

Painted turtle	S5	Thetford	5/7/99	Photo	J. Andrews
Painted turtle	S5	Thetford	5/7/99	Photo	J. Andrews
Painted turtle	S5	Thetford	6/23/99	Sight	J. Andrews
Painted turtle	S5	Thetford	6/23/99	Sight	J. Andrews
Painted turtle	S5	Thetford	6/23/99	Sight	J. Andrews
Painted turtle	S5	Thetford	6/23/99	Sight	J. Andrews
Painted turtle	S5	Thetford	6/23/99	Sight	J. Andrews
Wood turtle	S3	Thetford	4/15/99	Sight	J. Andrews
Wood turtle	S3	Thetford	9/29/99	Photo	J. Andrews

Appendix B

Records of Species Documented from Adjacent Towns but not Located During the 1999 Survey of Union Village Dam

Sorted by Class, Order, and Common Name

Jefferson salamander group	S2	Norwich	4/24/1975	specimen	Frey
Jefferson salamander group	S2	Norwich	4/24/1975	specimen	Frey
Jefferson salamander group	S2	Norwich	7/9/1975	specimen	W.W. Ballard
Jefferson salamander group	S2	Norwich	01/01/1980	photo	Ted Levin
Jefferson salamander group	S2	Norwich	01/01/1981	Photo	Ted Levin
Jefferson salamander group	S2	Norwich	01/01/1983	sight	Ted Levin
Jefferson salamander group	S2	Norwich	01/01/1989	sight	M. Desmeules
Jefferson salamander group	S2	Strafford	4/24/94	photo	S. Faccio
Northern leopard frog	S4	Norwich	01/01/1993	sight	W. W. Ballard
Northern leopard frog	S4	Strafford	7/22/95	sight	Steve Faccio, VINS
Brown snake	S4	Strafford	5/15/94	sight	S. Faccio

Appendix C

Records of Reptiles and Amphibians Documented from Orange and Windsor Counties That Were Not Located During the 1999 Survey of Union Village Dam

Allegheny dusky salamander	SR	Stockbridge	4/21/1962	specimen	J. Lazell
Common mudpuppy	S2			Unverified	Gary Pelton
Common mudpuppy	S2	Hartford	4/29/1982	specimen	
Common mudpuppy	S2	Springfield	12/30/82	sight	Mike Kazak
Common mudpuppy	S2	Hartford	1/1/97	Sight	Derek
Common mudpuppy	S2	Hartland	4/1/97	Sight	J. DiStefano Jr.
Common mudpuppy	S2	Hartford	4/1/98	Sight	P. Bartlett
Fowler's toad	S1	Hartford	4/22/1983	photo	M. Caduto
Mink frog	S4	Randolph	01/01/1983	sight	M. Desmeules
Mink frog	S4	Braintree	01/01/1983	sight	M. Desmeules
Mink frog	S4	Brookfield	12/2/1983	specimen	William Barnard
Mink frog	S4	Brookfield	9/22/1988	specimen	William Barnard
Northern leopard frog	S4	Bradford		sight	Daphne Sanborn
Northern leopard frog	S4	Royalton		Unverified	Dave Grant
Northern leopard frog	S4	Pomfret		Unverified	Dave Grant
Northern leopard frog	S4	Weathersfield		Unverified	Gary Pelton
Northern leopard frog	S4	Bridgewater	1/1/1822	Sight	Z. Thompson (author)
Northern leopard frog	S4		01/01/1981	specimen	William Barnard
Northern leopard frog	S4	Bradford	7/01/1986	photo	Ted Levin
Northern leopard frog	S4	Bradford	07/01/1986	photo	Ted Levin
Northern leopard frog	S4	Norwich	01/01/1993	sight	W. W. Ballard
Northern leopard frog	S4	Strafford	7/22/95	sight	Steve Faccio, VINS
Northern leopard frog	S4	Plymouth	7/31/98	Unverified	G. Hellyer
Brown snake	S4	Strafford	5/15/94	sight	S. Faccio
Copperhead	unk	Strafford	1/1/1960	Unver.	T. Southworth
Copperhead	unk	Norwich	1/1/1960	Unver.	T. Southworth
Eastern racer	S1	Corinth		Sight	E. F. Dunbar (contribu
Eastern racer	S1	Royalton	12/31/1911	Unverified	E. M. Wood Lovejoy (a
Eastern racer	S1	Newbury	9/17/97	Unverified	J. Andrews
Eastern racer	S1	Hartland	4/15/99	Unverified	J. Andrews
Eastern ribbon snake	S2	Tunbridge	6/1/79	Unverified	Dave Grant
Eastern ribbon snake	S2	Sharon	6/12/79	Unverified	Dave Grant
Timber rattlesnake	S1	Windsor		sight	Gus Aldrich
Timber rattlesnake	S1	Ascutney		Unver.	M. Romano (Author)
Timber rattlesnake	S1	Ludlow		Unver.	M. Romano (Author)
Timber rattlesnake	S1	South Royalton		Unver.	M. Romano (Author)
Timber rattlesnake	S1	Sharon		Unver.	M. Romano (Author)
Timber rattlesnake	S1	West Hartford		Unver.	M. Romano (Author)
Timber rattlesnake	S1	Springfield	10/9/1891	Sight	A. F. Rice
Timber rattlesnake	S1	Springfield	10/9/1891	Sight	A. F. Rice
Timber rattlesnake	S1	Springfield	10/9/1891	Sight	A. F. Rice
Timber rattlesnake	S1	Springfield	1/1/1902	Unverified	Miss Luthers Whitney
Timber rattlesnake	S1	Weathersfield	1/1/1923	Unverified	as told to G. Neilson
Timber rattlesnake	S1	Windsor	1-1-35	sight	Blood family
Timber rattlesnake	S1	Springfield	3/15/41	Field	Harold Trapido
Timber rattlesnake	S1	Windsor	1-1-50	sight	Blood family

Timber rattlesnake	S1	Ludlow	1-1-50	Unverified	
Timber rattlesnake	S1	Ludlow	1/1/1960	Unver.	
Timber rattlesnake	S1	Sharon	1-1-60	Unverified	
Timber rattlesnake	S1	Windsor	1-1-64	sight	Walt Cabell
Timber rattlesnake	S1	Norwich	6/14/90	Unver.	P. Nothnagle
Timber rattlesnake	S1	Springfield	8/15/94	Sight	Dan Magoon
Timber rattlesnake	S1	Randolph	6/5/97	Unverified	Nathan Webb
Timber rattlesnake	S1	Newbury	9/17/97	Unverified	J. Andrews

Desmognathus ochrophaeus	SR	Stockbridge	4/21/1962	specimen	J. Lazell
Necturus maculosus	S2			Unverified	Gary Pelton
Necturus maculosus	S2	Hartford	4/29/1982	specimen	
Necturus maculosus	S2	Springfield	12/30/82	sight	Mike Kazak
Necturus maculosus	S2	Hartford	1/1/97	Sight	Derek
Necturus maculosus	S2	Hartland	4/1/97	Sight	J. DiStefano Jr.
Necturus maculosus	S2	Hartford	4/1/98	Sight	P. Bartlett
Bufo fowleri	S1	Hartford	4/22/1983	photo	M. Caduto
Rana septentrionalis	S4	Randolph	01/01/1983	sight	M. Desmeules
Rana septentrionalis	S4	Braintree	01/01/1983	sight	M. Desmeules
Rana septentrionalis	S4	Brookfield	12/2/1983	specimen	William Barnard
Rana septentrionalis	S4	Brookfield	9/22/1988	specimen	William Barnard
Rana pipiens	S4	Bradford		sight	Daphne Sanborn
Rana pipiens	S4	Royalton		Unverified	Dave Grant
Rana pipiens	S4	Pomfret		Unverified	Dave Grant
Rana pipiens	S4	Weathersfield		Unverified	Gary Pelton
Rana pipiens	S4	Bridgewater	1/1/1822	Sight	Z. Thompson (author)
Rana pipiens	S4		01/01/1981	specimen	William Barnard
Rana pipiens	S4	Bradford	7/01/1986	photo	Ted Levin
Rana pipiens	S4	Bradford	07/01/1986	photo	Ted Levin
Rana pipiens	S4	Norwich	01/01/1993	sight	W. W. Ballard
Rana pipiens	S4	Strafford	7/22/95	sight	Steve Faccio, VINS
Rana pipiens	S4	Plymouth	7/31/98	Unverified	G. Hellyer
Storeria dekayi	S4	Strafford	5/15/94	sight	S. Faccio
Agkistrodon contortrix	unk	Strafford	1/1/1960	Unver.	T. Southworth
Agkistrodon contortrix	unk	Norwich	1/1/1960	Unver.	T. Southworth
Coluber constrictor	S1	Corinth		Sight	E. F. Dunbar (contrib
Coluber constrictor	S1	Royalton	12/31/1911	Unverified	E. M. Wood Lovejoy (
Coluber constrictor	S1	Newbury	9/17/97	Unverified	J. Andrews
Coluber constrictor	S1	Hartland	4/15/99	Unverified	J. Andrews
Thamnophis sauritus	S2	Tunbridge	6/1/79	Unverified	Dave Grant
Thamnophis sauritus	S2	Sharon	6/12/79	Unverified	Dave Grant
Crotalus horridus	S1	Windsor		sight	Gus Aldrich
Crotalus horridus	S1	Ascutney		Unver.	M. Romano (Author)
Crotalus horridus	S1	Ludlow		Unver.	M. Romano (Author)
Crotalus horridus	S1	South Royalton		Unver.	M. Romano (Author)
Crotalus horridus	S1	Sharon		Unver.	M. Romano (Author)
Crotalus horridus	S1	West Hartford		Unver.	M. Romano (Author)
Crotalus horridus	S1	Springfield	10/9/1891	Sight	A. F. Rice
Crotalus horridus	S1	Springfield	10/9/1891	Sight	A. F. Rice
Crotalus horridus	S1	Springfield	10/9/1891	Sight	A. F. Rice
Crotalus horridus	S1	Springfield	1/1/1902	Unverified	Miss Luthers Whitne
Crotalus horridus	S1	Weathersfield	1/1/1923	Unverified	as told to G. Neilson
Crotalus horridus	S1	Windsor	1-1-35	sight	Blood family
Crotalus horridus	S1	Springfield	3/15/41	Field	Harold Trapido
Crotalus horridus	S1	Windsor	1-1-50	sight	Blood family

Crotalus horridus	S1	Ludlow	1-1-50	Unverified	
Crotalus horridus	S1	Ludlow	1/1/1960	Unver.	
Crotalus horridus	S1	Sharon	1-1-60	Unverified	
Crotalus horridus	S1	Windsor	1-1-64	sight	Walt Cabell
Crotalus horridus	S1	Norwich	6/14/90	Unver.	P. Nothnagle
Crotalus horridus	S1	Springfield	8/15/94	Sight	Dan Magoon
Crotalus horridus	S1	Randolph	6/5/97	Unverified	Nathan Webb
Crotalus horridus	S1	Newbury	9/17/97	Unverified	J. Andrews

Appendix D

Identification and Natural History Notes on the Amphibians of Vermont

The Salamanders of Vermont

Species that spend their adult lives in or near water

Name	Field Marks	Habitat	Occurrence	Notes
Mudpuppy *Necturus maculosus* 20-33 cm	very large, totally aquatic dark-brown salamander with the external gills of a larvae throughout its life; wide flat heads with squared snouts; young larvae have light longitudinal stripes	large permanent bodies of water	primarily in the major tributaries of both Lake Champlain and the Connecticut river, as well as larger lakes draining into them	very difficult to locate other than through methods used for fish; has been killed in lampricide treatments of Lewis creek
Eastern newt *Notophthalmus viridescens* 5.7-12.2 cm	a small to medium-sized salamander with rough relatively dry skin and no vertical grooves along its sides; red in its adolescent terrestrial stage (red eft), becoming green as it matures with yellow undersides; at all stages it has red spots and a line horizontally through its eye	primarily hardwood woodlands at all elevations; terrestrial when young and aquatic when adult; adults found in permanent and semipermanent water that is slow or standing	very abundant in appropriate habitat throughout the state	toxic to predators in the red eft stage
Dusky salamander *Desmognathus fuscus* 6.4-11.5 cm	a muddy-brown medium-sized salamander with a rounded body and partially keeled tail; look for a light line extending from the eye down and backwards to the corner of the mouth	very wet soils along slow streams and in small seepage areas in hardwood forests particularly where the soil is richly organic and deep with a heavy, dark overstory	locally common in appropriate habitat; found at a wide range of elevations; apparently intolerant of occasional drying	partially keeled tail, wet habitat, and dark-brown color separate it from the elusive Mt. Dusky
Spring salamander *Gyrinophilus porphyriticus* 12.1-19 cm	large size of adults and larvae; solid salmon-pink with dark reticulations; heavy rounded body with laterally flattened tail	springs and cool, clean, well-oxygenated, headwaters of streams	can be locally abundant in high-elevation, small, fishless, (?) streams; distributed wherever permanent cool headwaters can be found	turn large flat rocks in streams that are over a square foot in area to locate this impressive salamander
N. two-lined salamander *Eurycea bislineata* 6.4-12 cm	delicate slender body with a flattened yellow or brown back contrasting with darker sides; adults have tails with yellow-orange undersides	very wet soils, gravel, or in crevices between rocks; in or along permanent streams or ditches in wooded areas	throughout Vermont at all elevations; it can be locally abundant	during or after heavy rains it wanders up to 100 meters from the nearest stream or seep

Species which lay their eggs in still water, but spend most of their adult lives on land

Name	Field Marks	Habitat	Occurrence	Notes
Blue-spotted salamander *Ambystoma laterale* 9-12 cm	a small but solid bodied salamander with a black background heavily spotted with blue, a narrow head, and closely spaced nostrils	lowland oxbows and temporary pools; usually near rocky hillsides	can be fairly abundant in good habitat; apparently scattered throughout the state	usually found with its hybrid relatives; not as subterranean as Jefferson's; much easier to find outside the breeding season
Blue-spotted salamander hybrids *Ambystoma laterale X jeffersonianum* 9-16 cm	larger than the above species with slightly wider heads and more widely spaced nostrils	same as above	same as above	usually found with and outnumbering its non-hybrid relatives
Jefferson salamander *Ambystoma jeffersonianum* 15-18 cm	a large, gray-brown, solid-color, salamander with a few small light flecks restricted to the lower sides; look for the broad head and widely spaced nostrils	rocky wooded areas with upland vernal pools and semipermanent ponds	apparently restricted to low hills outside of the Green Mountains	usually associated with the hybrids listed below; very difficult to locate outside of its breeding period in April
Jefferson salamander hybrids *Ambystoma jeffersonianum X laterale* 10-18 cm	more heavily spotted with blue than the Jefferson's with a narrower head and darker background color but still a large salamander	same as above	same as above	these hybrid complex salamanders often outnumber the non-hybrids with which they are found; they are almost entirely female and are genetically diverse
Spotted salamander *Ambystoma maculatum* 11.2-19.7 cm	a large heavy bodied salamander with a black background and yellow spots (the yellow of the spots is sometimes mixed with red or green)	found in greatest concentrations in woods around permanent or semipermanent, fishless, bodies of standing water with vegetation along the margins, but it also breeds in temporary pools	widespread throughout the state in wet wooded areas where appropriate breeding habitat can be found	easiest to find during its spring breeding season of April-May; at other times it remains underground
Four-toed salamander *Hemidactylium scutatum* 5.1-9 cm	a slightly rounded orange-brown body, an enamel-white belly with black spots and a constriction at the base of its tail	rocky oak-hickory hillsides including or adjacent to dark swamps or pools with sphagnum moss	probably restricted to the warmer areas of western and southern Vermont; it is never very abundant	only recently has it been discovered in the Lake Champlain Basin

Species which are entirely terrestrial throughout their lives

Name	Field Marks	Habitat	Occurrence	Notes
Redback salamander *Plethodon cinereus* 5.7-10 cm	small slender and delicate with a flat red back; sometimes dark brown or gray morphs are found	mature hardwood forests that are not highly acidic in nature appear to be the best habitat but it is found in smaller numbers in any wet woods	widely distributed at all elevations throughout the state; often very abundant under ideal conditions	our only salamander that does not spend its larval stage in the water, hence it can be found far from the nearest standing water

Unconfirmed species found in nearby states

Marbled salamander *Ambystoma opaqum* 9-10.7 cm	short, heavy, rounded, body with a black background and strong pewter bars or blotches	dry hillsides with semipermanent or temporary pools	reported once in the 50's from the Inman Pond area of Fair Haven	not verified in the state; unlike other *Ambystoma* species it migrates to breeding sites in fall
Mountain dusky salamander *Desmognathus fuscus* 7-10 cm	look for a redback-like dusky with a rounded tail and a light line from the eye to the corner of its mouth	redback-type habitat under logs and rocks but along streams and ravines	one juvenile reported from within the state; no populations of adults have been located	this species is found across the border in New York State; the Taconics would be a good place to look for it
Slimy salamander *Plethodon glutinosis* 12.1-17.2 cm	a large slender black salamander with white spots and very sticky skin secretions	shaley stream-banks or road-cuts	limited amounts of this habitat occur in Vermont, if found, one would expect it to be in southern Vermont	isolated populations are reported from New Hampshire but the contiguous range begins further south in southern New York

Version 3, James S. Andrews, April 1996; most sizes and names are taken from Reptiles and Amphibians of Eastern/Central North America by Roger Conant and Joseph T. Collins, 1991

The Frogs of Vermont

Name	Field Marks	Habitat	Occurrence	Notes
American toad *Bufo americanus* 5.1-9 cm	rough warty skin with small black spots; usually one or two large warts per spot; belly with black markings	widespread in many habitats, at all elevations, but most common in woodlands with small bodies of permanent and semipermanent water	rarely found in dense concentrations; often in yards and driveways under lights but seems to most abundant in scattered forested areas	glands on its head release toxins when it is eaten
Fowler's toad *Bufo woodhousii fowleri* 5.1-7.5 cm	rough warty skin with large black spots; usually many small warts per spot; plain white belly; other differences need to be studied carefully with text diagrams	sandy soils ?	very rare, two reports from southern Vermont; we are at the northern extreme of its range	the mating call is a very distinctive bleating cry; somewhat like the crying of a baby or bleating of a sheep
Gray treefrog *Hyla versicolor* 3.2-5.1 cm	rough, bumpy, skin similar to a small toad but with a small white patch under the eye and adhesive disks on its toes; usually grayish but it sometimes can be found in background colors from white to dark green	in the vicinity of slow moving or standing water with abundant vegetation	widespread if appropriate breeding habitat can be found; usually in trees when not breeding	can be located by its call during breeding season (May - July), very difficult to locate otherwise
Bullfrog *Rana catesbeiana* 9-15.2 cm	very large size, looks like large green frog except dorsolateral ridges do not extend down the edges of the back past the tympanum (ear)	standing or slow-moving permanent water, usually at lower elevations in or near large water bodies	locally common, but missing from large areas that do not contain the appropriate habitat	wanders from water only during heavy rains
Green frog *Rana clamitans* 5.7-9 cm	a medium-sized green frog with ridges extending well past the tympanum and with stripes on the hind legs oriented across the legs	permanent water of all kinds and sizes, (rivers, ponds, lakes)	very widespread at all elevations but most abundant on standing or slow moving well vegetated water bodies	this is the common pond frog; it wanders from water only during heavy rains; it's color and pattern vary tremendously from light to very dark-green and unspotted to heavily spotted
Mink frog *Rana septentrionalis* 4.8-7 cm	very much like a small green frog but the ridges usually don't extend past the tympanum (ear); it is heavily spotted with spots on, not bands crossing the legs; when agitated it releases a burst of garlic scent	slow-moving heavily vegetated bodies of water adjacent to larger bodies	locally common only in the far north and central part of the state	often reported to be associated with northern spruce-fir forests or at least the latitudes where these forests are found

Name	Field Marks	Habitat	Occurrence	Notes
Wood frog *Rana sylvatica* 3.5-7 cm	a medium-sized frog that has a plain-brown back with black patches below the eyes and around the tympanum, the upper lip is white in contrast	very widespread in woodlands of all elevations, where semipermanent or temporary pools can be found to breed in	very abundant in woodlands throughout the state	the color of the brown varies tremendously from very light to dark and reddish to brown
Northern leopard frog *Rana pipiens* 5.1-9 cm	a medium-sized frog that has oval spots on a green or gold background with white on the underside of the legs	often found in fields or woods near large lowland marshes and swamps	can be locally very abundant but missing from high elevations and other portions of the state	compare carefully with the Pickerel frog
Pickerel frog *Rana palustris* 4.4-7.5 cm	a medium-sized frog that has roughly rectangular spots on a brown background; look for the yellow undersurface of the legs on the adult frogs	beaver meadows and adjoining woods near clean, cool, permanent, water	never very abundant but compared to leopard frogs it is more widespread in woods and mountains throughout the sate	reported to release toxins capable of killing other amphibians when in a confined area
Spring peeper *Pseudacris crucifer* 1.9-3.2 cm	a very small brown frog with thin dark lines that often form a rough X on its back; small adhesive disks on its toes	in vegetation or woods near heavily vegetated swamps and marshes of all sizes; apparently missing from the immediate areas populated by bullfrogs	can be very abundant and is widespread at all elevations throughout Vermont	with the occasional exception of moist woods in late summer and early fall it can be difficult to locate other than by its call in the spring
Western chorus frog *Pseudacris triseriata* 1.9-3.9 cm	a peeper-sized frog with parallel stripes running the length of its back	apparently peeper-type habitat	one population was located in Grand Isle county in the 1980's, but it has not been found since	it has not been located at all in Vermont in recent years; state endangered; we are at the eastern limit of its range

Version 2, James S. Andrews, April 1996 most sizes and names are taken from Reptiles and Amphibians of Eastern/Central North America by Roger Conant and Joseph T. Collins, 1991

Appendix E

Vermont Reptiles and Amphibians with State Heritage Ranks and Explanations

Amphibians and Reptiles of Vermont

Nongame and Natural Heritage Program
Vermont Department of Fish and Wildlife
103 South Main St.
Waterbury, VT 05671-0501
May 1999

Common Name	Scientific Name	State Rank
Reptiles		
Spiny Softshell	*Apalone spinifera*	S1
Common Snapping Turtle	*Chelydra serpentina*	S5
Painted Turtle	*Chrysemys picta*	S5
Spotted Turtle	*Clemmys guttata*	S1
Wood Turtle	*Clemmys insculpta*	S3
Common Map Turtle	*Graptemys geographica*	S3
Common Musk Turtle	*Sternotherus odoratus*	S2
Five-lined Skink	*Eumeces fasciatus*	S1
Eastern Racer	*Coluber constrictor*	S1
Timber Rattlesnake	*Crotalus horridus*	S1
Ringneck Snake	*Diadophis punctatus*	S4
Eastern Rat Snake	*Elaphe obsoleta*	S2
Milk Snake	*Lampropeltis triangulum*	S5
Northern Water Snake	*Nerodia sipedon*	S3
Smooth Green Snake	*Liochlorophis vernalis*	S4
Brown Snake	*Storeria dekayi*	S4
Redbelly Snake	*Storeria occipitomaculata*	S5
Eastern Ribbon Snake	*Thamnophis sauritus*	S2
Common Garter Snake	*Thamnophis sirtalis*	S5
Amphibians		
Jefferson Salamander	*Ambystoma jeffersonianum*	S2
Blue-spotted Salamander	*Ambystoma laterale*	S3
Spotted Salamander	*Ambystoma maculatum*	S5
Marbled Salamander	*Ambystoma opacum*	SR
Northern Dusky Salamander	*Desmognathus fuscus*	S4
Allegheny Dusky Salamander	*Desmognathus ochrophaeus*	SR
Northern Two-lined Salamander	*Eurycea bislineata*	S5
Spring Salamander	*Gyrinophilus porphyriticus*	S4
Four-toed Salamander	*Hemidactylium scutatum*	S2
Northern Redback Salamander	*Plethodon cinereus*	S5
Common Mudpuppy	*Necturus maculosus*	S2
Eastern Newt	*Notophthalmus viridescens*	S5
American Toad	*Bufo americanus*	S5
Fowler's Toad	*Bufo fowleri*	S1
Gray Treefrog	*Hyla versicolor*	S5
Spring Peeper	*Pseudacris crucifer*	S5
Western Chorus Frog	*Pseudacris triseriata*	S1
Bullfrog	*Rana catesbeiana*	S5
Green Frog	*Rana clamitans*	S5
Pickerel Frog	*Rana palustris*	S4
Northern Leopard Frog	*Rana pipiens*	S4
Mink Frog	*Rana septentrionalis*	S4
Wood Frog	*Rana sylvatica*	S5

Vermont Nongame & Natural Heritage Program
Department of Fish and Wildlife
Explanation of Legal Status and Information Ranks

State Status As per the Vermont Endangered Species Law

E: Endangered: in immediate danger of becoming extirpated in the state
T: Threatened: with high possibility of becoming endangered in the near future

Information categories only; not established by law

SC: Special Concern: rare; status should be watched
PE: Proposed for endangered
PT: Proposed for threatened

State Ranks of Plants, Animals, and Natural Communities

State ranks are assigned by the Nongame & Natural Heritage Program based on the best available information. They are not established by law. Ranks are reviewed annually.

S1: Very rare, generally 1 to 5 occurrences believed to be extant and/or some factor(s) making it especially vulnerable to extirpation from the state
S2: Rare, generally 6 to 20 occurrences believed to be extant and/or some factor(s) making it vulnerable to extirpation in the state
S3: Uncommon, believed to be more than 20 occurrences and/or there is some threat to it in the state
S4: Apparently secure in state, often with more than 100 occurrences
S5: Demonstrably secure in state

SA: Accidental in state
SE: An exotic established in state
SH: Known from historical records only
SR: Reported from the state, but without persuasive documentation
SRF: Reported in error but this error persisted in the literature
SP: Possible in the state but no reported or documented records
SSYN: No longer considered a taxon in the state.
SZ: Not of practical conservation concern because there are no definable occurrences
SX: Extirpated from the state
SU: Status uncertain
?: Denotes provisional rank

Appendix F

Forest Management Practices to Minimize the Negative Impacts on Vermont Reptiles and Amphibians

Forest Management Practices to Minimize Negative Impacts on Vermont Reptiles and Amphibians

Most amphibians spend the majority of their lives away from water in the surrounding woods. The wetlands, vernal pools, and ponds are critical for breeding of most species but the forests are also critical for the foraging and wintering of those species. Some local amphibians migrate 300 meters or more from wintering and foraging areas to breeding ponds. Most snakes, some turtles, and Vermont's only lizard spend the majority of their lives away from water. Hence management of wetlands and the surrounding woods both have an impact on reptiles and amphibians. Some species of larger snakes and most land turtles require many years to reach breeding age. Direct mortality or removal of breeding adults can have a devastating impact on a population.

Specific management plans for rare, threatened, or endangered species

Learn to recognize Vermont's rare, threatened, and endangered species.

(habitat in which they are found should be managed specifically for them)

(contact the Vermont Non-game and Natural Heritage Program, they will be interested in the distribution information and may be able to make specific management suggestions)

General

Maintain large down trees (2 per acre, 7 per hectare), dead standing trees, and a future supply consisting of older standing trees.

Maintain standing trees with knotholes and dead branches.

Within areas that are heavily cut, patches of older trees should be left in addition to the scattered mature trees.

Maintain a thick layer of deciduous litter.

Softwood plantations limit the number and diversity of amphibians.

(decreased coarse woody debris, decreased structural diversity, decreased hardwood leaf litter, increased acidity)

(in these situations maintaining pockets of hardwoods and leaving large debris on the ground would help to minimize the impact)

Long rotations provide the old mature growth and dense forest cover amphibians prefer.

(as forests age they show increasing amphibian abundance up to an age of 60 to 70 years old in wet cool habitats and up to 120 years in warm, dry, lowland habitats)

Minimize compaction of the soil and direct mortality by keeping heavy equipment off the site when the ground is saturated.

(winter logging or logging in late summer and early fall conditions should help minimize this effect)

Protect and maintain shrub cover in the forest and on forest edges.

Openings

Maintain a natural pattern of forest cover with small forest breaks.

Large clear-cuts regularly show fewer amphibians than adjacent older growth.

(successive short rotation clear-cuts showed the lowest abundance of amphibians)

(natural disasters such as diseases and storms seem to have less of an effect on amphibian abundance as clear-cuts, probably because of the amount of coarse woody debris left behind)

(large clear-cuts seem to block the movements of some amphibian species)

Small upland meadows with nearby woods provide partial habitat requirements for some snake species.

In small upland meadows exposed rock piles, sawdust piles, and coarse woody debris can provide good habitat for snakes.

Wetland areas

Maintain the ability of swamps, vernal, and semipermanent pools to hold water.

Do not create ditches and ruts that will hold water only briefly. Amphibians often lay their eggs in these small patches of water which dry too soon to permit the larvae to transform and leave. They should either be prevented or they should be deep and shaded enough to hold water through July.

Streams, ponds, and vernal pools should be kept shaded and silt should be kept out.

(among other effects, silt fills the spaces in stream beds where the larval amphibians hide and feed)

(direct sun may speed the rate of evaporation in vernal pools)

Equipment and logs should be kept out of vernal pools and other wetlands.

(small amounts of coarse woody debris or single trees that fall into a wetland are not harmful but vernal pools should not be filled with debris)

Buffer strips should be maintained around all water bodies including streams, ponds, and vernal pools.

(these strips minimize siltation, maintain shade, maintain undisturbed soil and deep leaf litter, provide patches of older growth as sources for recolonization, and provide movement corridors)

(the width of uncut buffer strips should be a minimum of 30 meters, with a wider zone of up to 100 meters where cutting and its impacts are limited)

(deMaynadier and Hunter suggest no more than 25% of the basal area should be cut in this second tier buffer)

(buffer strips should be widest where streams are larger, where the intensity of harvest is greatest, where the surrounding terrain is steepest, or where rare, threatened, or endangered species are found)

Equipment should be kept out of forested seepage areas.

Forest cover over seepage areas should be maintained.

Chemicals

Amphibians absorb any chemicals which are in the water (dew, ground water, streams etc.) around them.

(minimize use of herbicides, pesticides, etc.)

(one study suggests that CaCl spread on roads to minimize dust may be a barrier to amphibian movement)

Roads

Minimize the number of roads, size of roads, and the amount of traffic on roads.

(a rural paved road in upstate New York killed between 50 and 100 percent of migrating amphibians breeding near it)

Permanent roads should be planned not to intercept the annual movements of reptiles and amphibians between breeding, foraging and wintering habitats.

Other Species

Allow only moderate grazing after the breeding season.

Keep livestock out of the riparian zone and away from vernal pools and ponds.

If livestock need access to a pond or a lake, limit it. Maintain as much naturally vegetated shoreline as possible.

Don't introduce fish in streams and ponds where they were not previously found.

(many fish feed on amphibian eggs and larvae, and absence of predacious fish is a primary requisite of vernal pool breeders)

Open areas with dense annual or shrubby growth near water bodies or on the edge of woods provide foraging areas for some species

open areas that are to be kept open should be cut high and either not raked or raked by hand, (direct mortality should be minimized)

these areas could be cut after the ground is frozen and before the first snows (reptiles and amphibians would no longer be active)

General amphibian microhabitat requirements include;

breeding locations that hold water at least through July,
coarse woody debris in adjacent forested areas,
foliage height diversity in adjacent forested areas,
canopy cover over breeding and foraging areas,
deep deciduous leaf litter for moisture retention and feeding,
cool and moist conditions.

General reptile microhabitat requirements include;

coarse woody debris (standing and down),
small open patches for basking, mixed with well shaded refugia for warm weather and feeding,
undisturbed areas in and around wetlands for feeding and breeding,
access to safe denning areas.

Many of the above ideas were taken from a recent review of the literature regarding amphibians and forest management. This review includes an extensive bibliography that might be of interest.

deMaynadier, P. and M. Hunter. 1995. The relationship between forest management and amphibian ecology: a review of the North American literature. Environmental Reviews 3: 230-261.

Additional suggestions for this list were provided by the author (J. Andrews), P. Bartelt, S. Droege, S. Jackson, L. Raw, and R. Waldick.

James Andrews, 7/96

Appendix G

Aerial Photos Taken on the Low-elevation Flyover, April 1999

VP 1

VP2

VP3&4

VP 5, 6, 7

VP 8

VP 11

BD 16

EP 9 & 10


Seepage
Area
not
mapped


Oxbow -
moving
water