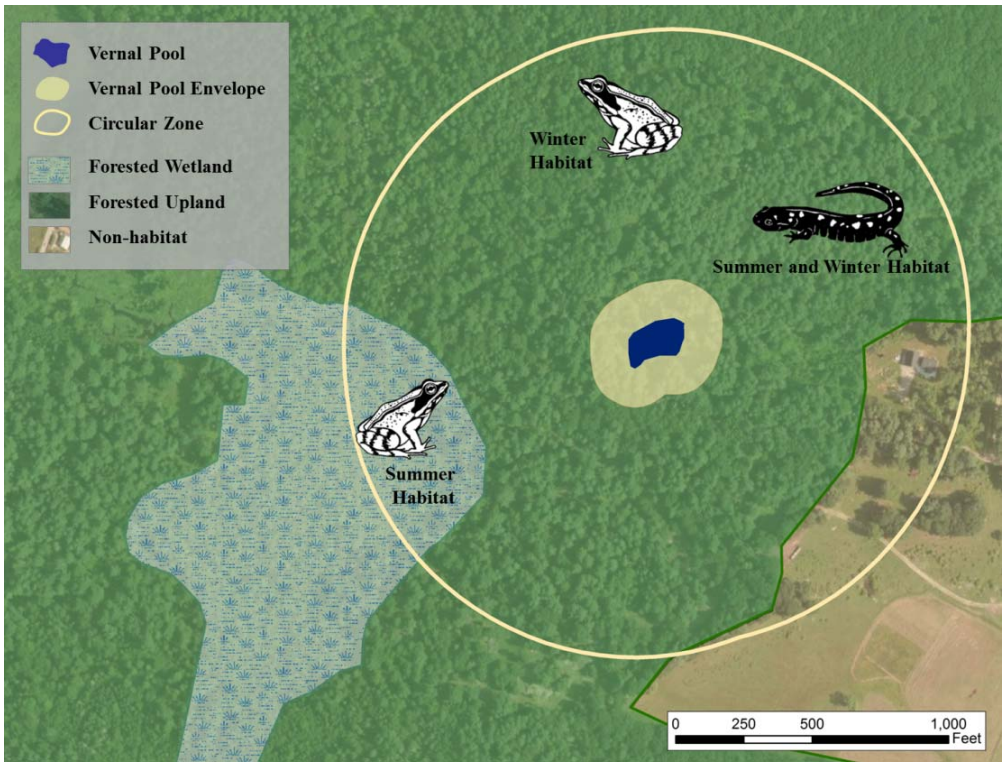
US Army Corps of Engineers ®
New England District

Vernal Pool
Best Management Practices (BMPs)

Vernal pool-breeding amphibians[1] depend upon both the vernal pool (VP) depression and surrounding envelope and critical terrestrial habitat[1] (CTH) for survival. The envelope and CTH support the non-larval life-cycle stages of VP-breeding amphibian species and protect the water quality of the VP. Adult amphibians spend as little as two or less weeks in breeding pools before they move back into the forests where they spend the vast majority of their lifecycle (feeding and hibernating). Adult pool-breeding amphibians typically travel as much as 750 feet (and often ≥1 mile) to reach non-breeding habitats. Juvenile dispersing amphibians may move many miles to reach new breeding pools.



During their life cycle, some species require two or more distinct habitats. For example, in southern and central Maine, the wood frog uses VPs to breed, forested wetlands and moist stream bottoms to summer, and well-drained uplands to hibernate (Figure 1). Spotted salamanders typically breed in VPs and rely on small mammal burrows (often shrews) in upland forests for both summer habitat and for hibernating.

Figure 1

Direct, secondary, and cumulative adverse effects to all VPs, including their envelopes and CTH, should be avoided and minimized[2] to the maximum extent practicable. The Corps may require certain designs or special conditions for avoidance, minimization and compensatory mitigation measures.

The concentric circle (Figure 2) and directional corridor concepts [Figures 3(a)-3(c)] are management tools used to protect vernal pools. The concentric circle concept is outlined in the documents in Endnotes 2(a) and (b). The document at Endnote 2(a) includes the following conservation recommendations using the concentric circle concept:

1. Avoid disturbance within the VP depression and envelope (extends 0-100 feet from the VP depression's edge)

2. Limit development to less than 25% of the CTH (extends 100-750 feet from the VP depression's edge).
3. Exclude roads and driveways from the VP envelope.
4. Establish directional corridors consisting of unfragmented forest with at least a partly-closed canopy of overstory (>50% cover) trees to provide shade, deep litter and woody debris. Maintain duff layer, native understory vegetation and downed woody debris in the VP depression, envelope, CTH, and corridors connecting wetlands and VPs.
5. Minimize impedance to amphibian terrestrial passage. Cape Cod style-curbing[3] or no curbing options should be used for new road construction.

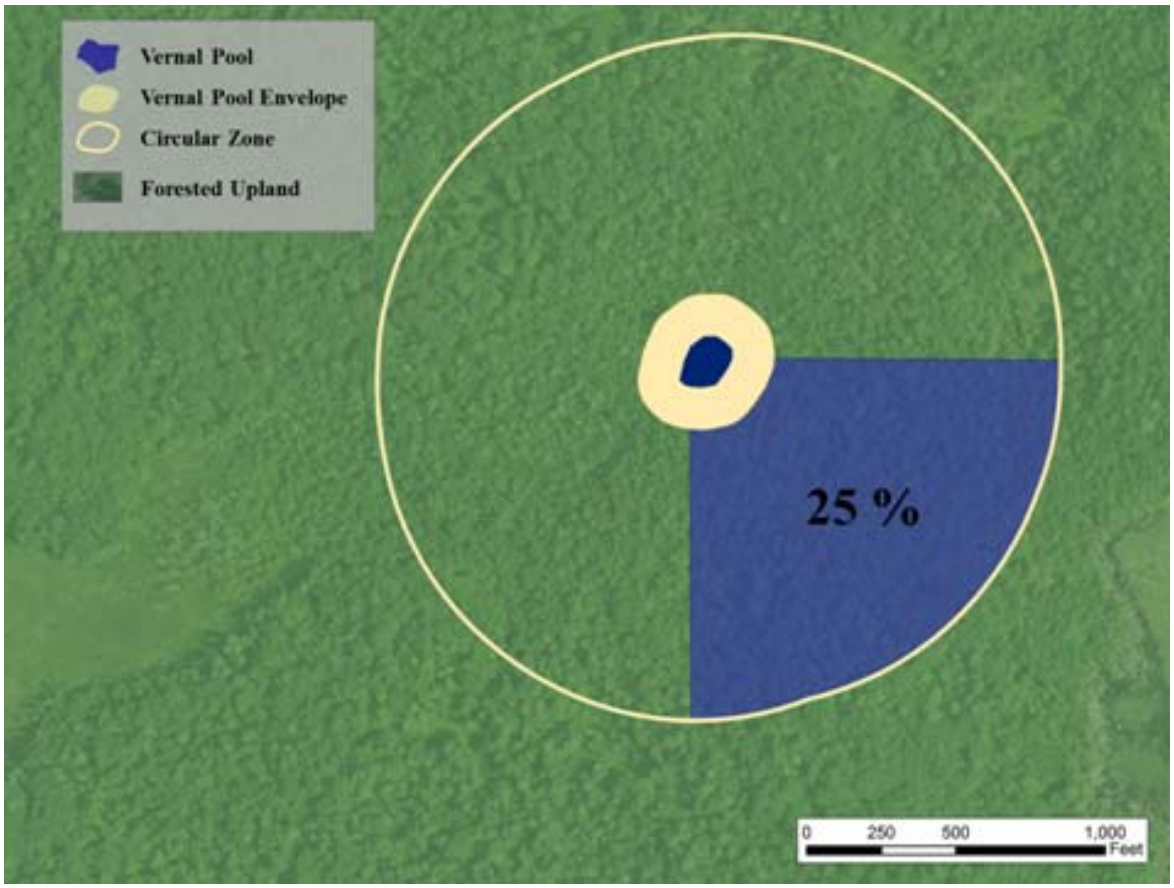


Figure 2

Directional corridors allow a flexible approach to conserving pool-breeding amphibian habitat, focus resources on conserving more essential habitat, and provide a balance between the human and amphibian communities and an alternative to circular zones, which often do not meet the terrestrial habitat needs of VP species. Directional corridors are designed to link habitats used by pool-breeding amphibians (i.e., breeding pools, forested wetlands, forested uplands) with forested travel corridors at appropriate migration scales (750 feet or greater). Landowners, consultants, and regulators can work together to design a corridor that is site-specific. This flexible approach considers pool-breeding amphibian habitat as a network of connected habitat elements. It can be better tailored to individual landowner needs by changing the shape of protected land so the landowner is not responsible for conserving non-habitat. See Fig. 2 on page 448 and the "Conservation Planning" section beginning on Page 449 of the attached paper for more details. Directional corridors may not work when landowners do not control the property and in that case the concentric circle concept is a useful biological guideline.

Figure 3a shows the envelope and CTH, which is a circular zone around a VP. This includes field habitat that is not suitable for VP-breeding amphibians (they are forest-dwelling species). The method of limiting development to 25% of this CTH and conserving 75% would ineffectively include land unsuitable for amphibians but suitable for development.

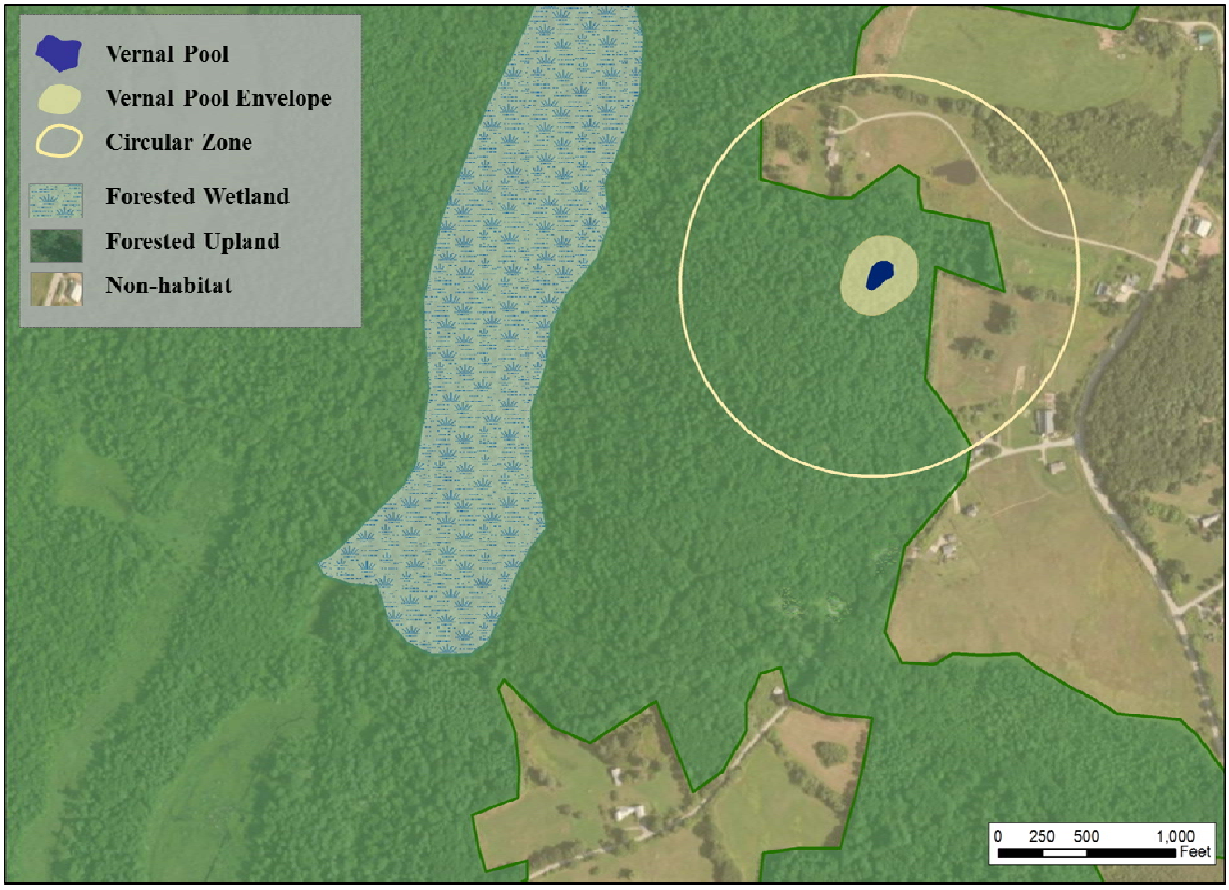


Figure 3a

Conversely, the Wood Frog Directional Corridor in Figure 3b illustrates an alternative where a zone is shaped to connect other elements of amphibian habitat for wood frogs in southern and central Maine. Here, the VP is linked to forested wetlands used by wood frogs in the summer and includes a habitat corridor of forested uplands that is suitable upland habitat for hibernation. The directional corridor could be expanded (see dashed yellow line) to capture additional, suitable, upland habitat, however the Wood Frog Directional Corridor shows an approach that conserves the same amount of land as a circular zone.

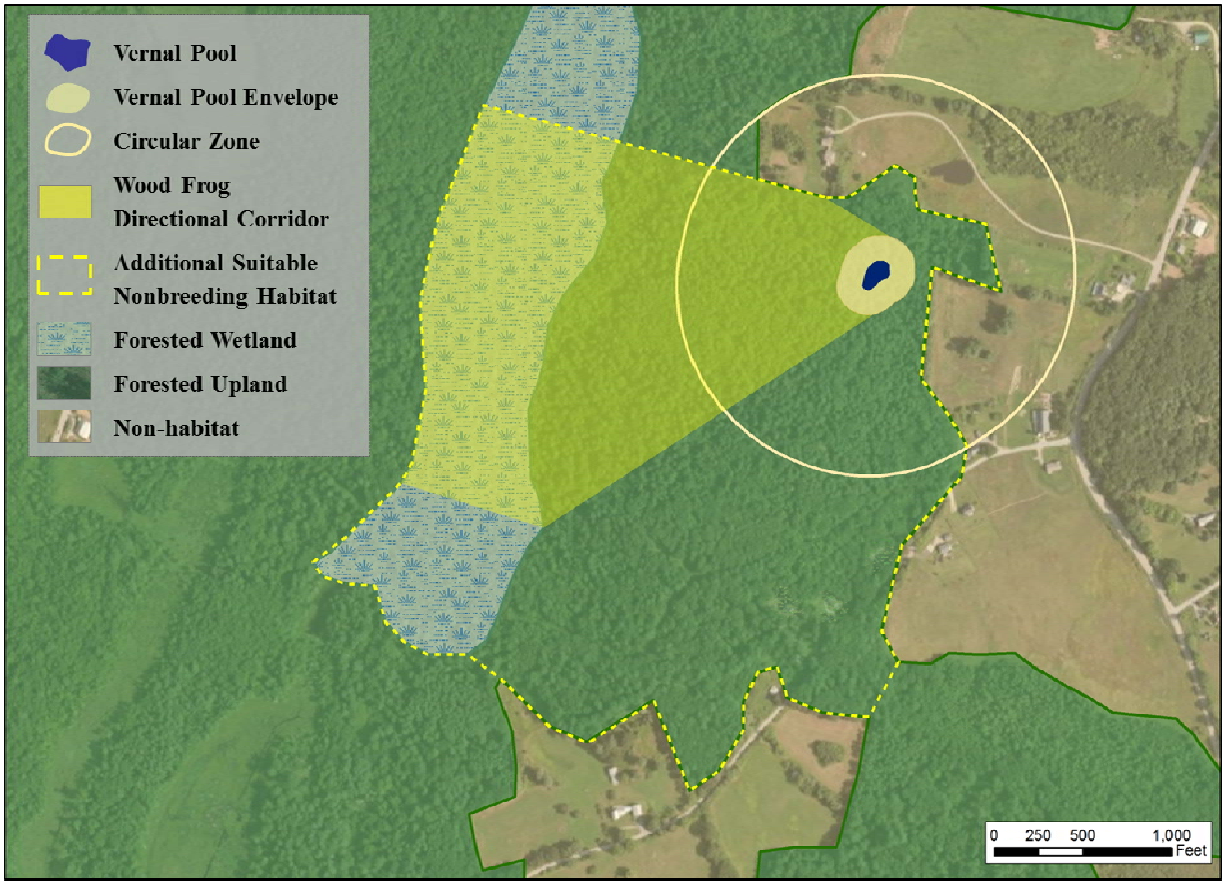


Figure 3b

The Spotted Salamander Directional Corridor in Figure 3c shows suitable upland habitat for a spotted salamander in New England that is equivalent in area to that of the circular zone area, while the dashed blue line shows additional suitable upland habitat that exceeds the area of the circular zone.

Other site-specific directional corridors may connect VPs to other VPs or to good forested upland habitat. Directional corridors must be tailored to the target species of the VP being managed. The habitat needs of the target species post-breeding depend on where the VP is geographically located. For example, wood frogs in Maine utilize all 3 habitat elements (breeding pools, forested wetlands, forested uplands) (Figure 3b), while spotted salamanders may rely more heavily on the breeding pools and forested uplands for foraging and hibernation (Figure 3c). The best available scientific data for species in a particular geographic region must be used. Potential directional corridors may be determined initially by using aerial photography, but habitat quality should be determined on the ground.

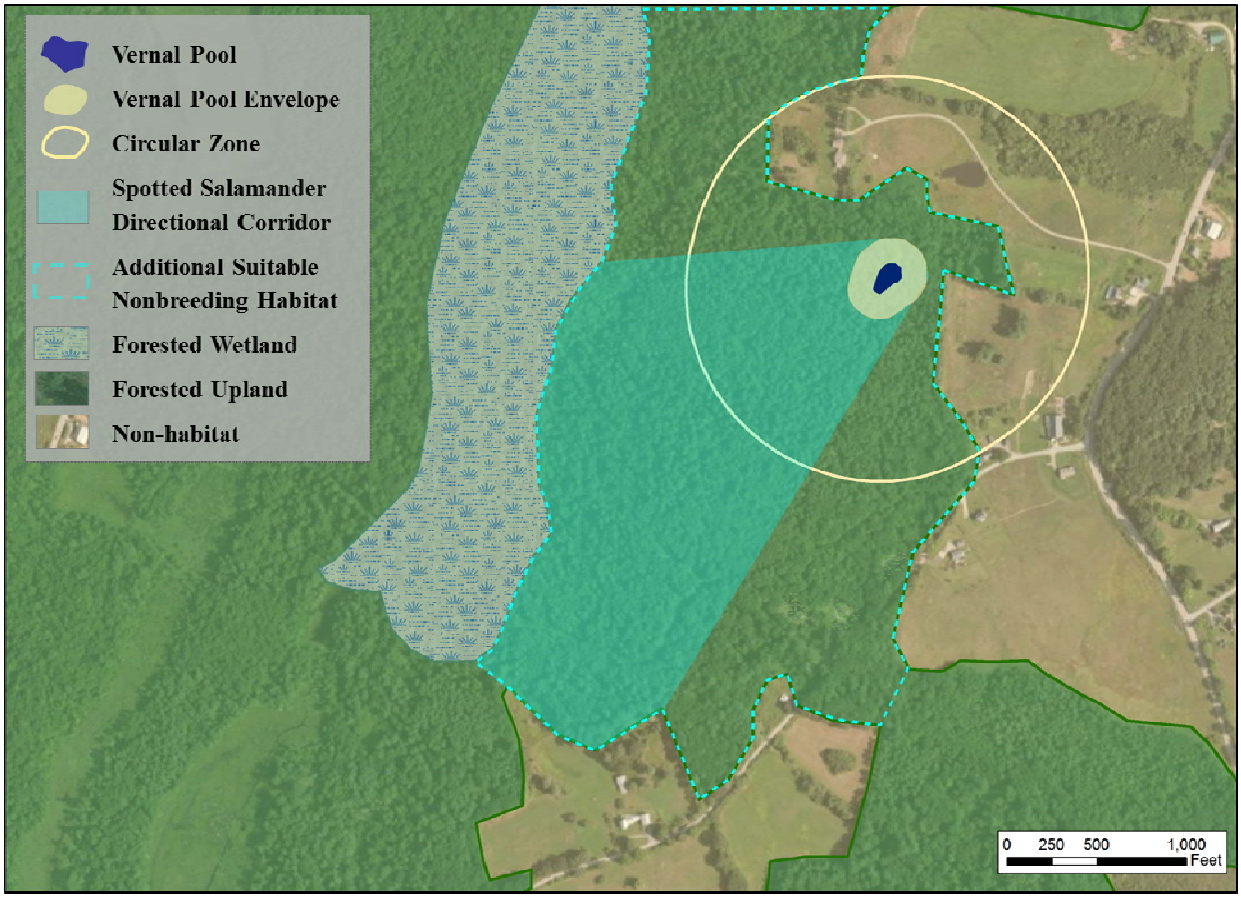


Figure 3c

[1] The Corps state general permits list the following as obligate VP indicator species: wood frog, spotted salamander, blue-spotted salamander, marbled salamander, Jefferson's salamander and fairy shrimp. See the state general permits for the definition of a VP. Vernal pool areas are:

- Depression (includes the VP depression up to the spring or fall high water mark, and includes any vegetation growing within the depression),
- Envelope (area within 0-100 feet of the VP depression's edge), and
- Critical terrestrial habitat (area within 100-750 feet of the VP depression's edge).

The envelope and CTH protect the water quality of the breeding site (e.g., providing shade, leaf litter, and coarse woody material) and support the non-larval life-cycle stages of amphibian species.

[2] The following documents also provide avoidance and minimization practices, and conservation recommendations, and are located at www.nae.usace.army.mil/missions/regulatory.aspx >> Vernal Pools:

a. Science and Conservation of Vernal Pools in Northeastern North America, Calhoun and deMaynadier, 2008. Chapter 12, Conservation Recommendations section, Page 241, is particularly relevant.

b. Best Development Practices: Conserving pool-breeding amphibians in residential and commercial development in the northeastern U.S., Calhoun and Klemens, 2002. Chapter III, Management Goals and Recommendations, Pages 15 – 26, is particularly relevant.

[3] Cape Cod Curbing: For smaller roads and driveways, the most important design feature to consider is curbing. Granite curbs and some traditional curbing can act as a barrier to amphibian and hatchling turtle movements. Large numbers of salamanders have been intercepted in their migrations by curbs and catch basins. Use of Cape Cod curbs rather than traditional curbing may be one solution. Alternatively, where stormwater management systems require more traditional curbing, it may be possible to design in escape ramps on either side of each catch basin. Cape Cod curbing is shown on Page 35 of the document cited in Footnote 2(b) above. Bituminous material is not required; other materials such as granite are acceptable.