

sites are found in and around the former Air Center that is located in southwest Santa Rosa. This area contains one of the largest undeveloped blocks of land within the city limits of Santa Rosa. Urban development is proposed on or near locations containing four of the eight known breeding sites in the Santa Rosa area (EIP Associates 1994, 2000). The airport was closed and the property sold to the City of Santa Rosa in the mid-1980s. The City of Santa Rosa is proposing the majority of the area be developed as part of their Southwest Area Plan (EIP Associates 1994, 2000).

Urban development of the Santa Rosa area is proceeding rapidly. Demographic data obtained from the City of Santa Rosa Housing and Community Development Commission indicate that, since 1980, Santa Rosa has experienced a greater than 53 percent increase in its population. From 1980 until 1997, the number of housing units grew by 66 percent from 35,403 units in 1980 to 53,558 units by January 1, 1997 (M. Enright, pers. comm., 2001).

Five known breeding sites were lost within the past 2 years, two of which were lost due to commercial development with another lost to urban development/housing. In June 2002, a fourth breeding site near Cotati was destroyed when the pond was filled for unknown reasons (D. Cook, *in litt.*, 2002; L. Davis, pers. comm., 2002). The Cotati location was considered highly productive for salamanders (D. Cook, *in litt.*, 2002). A fifth, and previously unknown, breeding site near Cotati was destroyed shortly after the emergency listing went into effect (67 FR 47726) (D. Wooten, Service, pers. comm., 2002). We were not aware of this occurrence at the time the emergency rule was published. Salamander larvae were found in a roadside ditch that backed up onto a large pool on private property (CNDDDB 2002). It is likely this pool served as the breeding site for salamanders in this area. This site was located in an area where road sightings of tiger salamanders commonly occurred in absence of a known breeding site. The pool was drained without appropriate authorizations under County of Sonoma ordinances (P. Shannin, U.S. Army Corps of Engineers (Corps), pers. comm., 2002; P. Stamp, Sonoma County Planning Department, pers. comm., 2002).

Roads and Highways

California tiger salamanders require a large amount of barrier-free landscape for successful migration (Shaffer *et al.* 1993; Loreda *et al.* 1996). Roads and highways are permanent physical obstacles that can block the animals

from moving to new breeding habitat, or prevent them from returning to their breeding ponds or estivation sites. Road construction can reduce or completely eliminate the viability of a breeding site, and in some cases, larger portions of a metapopulation.

All the pools at the known extant Sonoma County California tiger salamander breeding sites are within 450 m (1,476 ft) of roads of various sizes. Findlay and Houlihan (1996) found that roads within 2,000 m (1.2 mi) of wetlands adversely affected the number of amphibian species. At this time, it is still possible for salamanders at breeding sites associated with the Air Center to migrate to the FEMA/Broadmore North Preserves. A proposed through-street and high-density housing will eliminate this migration corridor, leading to fragmentation and further isolation of remaining breeding sites. If this planned through-street and accompanying high-density housing are completed, only three breeding sites will remain where salamanders can access more than one breeding pool without crossing roads.

Large numbers of California tiger salamanders at some locations in the Central Valley, up to 15 or 20 per mile of road (J. Medeiros, Sierra College, pers. comm., 1993), have been killed as they crossed roads on breeding migrations (Hansen and Tremper 1993; S. Sweet, *in litt.*, 1993). Estimates of losses to automobile traffic range from 25 to 72 percent of the breeding population for several different populations of the species (Twitty 1941; S. Sweet, *in litt.*, 1993; Launer and Fee 1996). Curbs and berms as low as 9 to 13 cm (3 to 5 in), which allow salamanders to climb onto the road but can restrict or prevent their movements off the roads, can turn the roads into sources of high mortality (Launer and Fee 1996; S. Sweet, *in litt.*, 1998). Automobile traffic along Stony Point Road in western Santa Rosa has probably quadrupled in the past 5 years (D. Cook, pers. comm., 2002). This was once a moderately used rural road which is now a major route for commuter traffic. Between November 21, 2001, and December 5, 2001, 26 California tiger salamanders were found killed by cars on this road between Santa Rosa and Cotati. Fourteen of these dead California tiger salamanders were found along Stony Point Road near Meachum Road (D. Cook, pers. comm., 2002). The Engel Preserve is adjacent and north of Todd Road. A proposed road widening project along Todd Road would likely increase traffic and result in an increased threat of roadkill for salamanders migrating between the

Engel Preserve and salamander estivation habitat south of Todd Road.

Description of the Breeding Sites

(1) *Hall Road Preserve*: This 74-ha (183-ac) site is owned by CDFG. It is the largest preserved area where the Sonoma County California tiger salamander is currently known to occur. It contains two pools with ponding levels adequate for successful breeding during drought years. This preserve contains seven additional breeding pools that are relatively shallow and do not pond water long enough for successful breeding in years of moderate to low rainfall. Surveys conducted over the past 2 years indicate this preserve does not function as a highly productive breeding site (Cook and Northern 2001). The land surrounding the preserve is privately owned, and the City of Santa Rosa has issued permits for urban development. Urban development has occurred on adjacent lands to the east and west, and agriculture to the north of the preserve. Exotic predators of the salamander, such as Louisiana crayfish (*Procambarus clarkii*), stickleback fish (*Gasterosteus aculeatus*), and possibly bullfrogs (*Rana catesbeiana*) are present at the Hall Road Preserve.

(2) *FEMA/Broadmore North Preserves*: This breeding site consists of two properties, the FEMA Preserve and the Broadmore North Preserve. The 24-ha (59-ac) FEMA Preserve is owned by CDFG and contains one of the most productive Sonoma County California tiger salamander breeding sites. The 6.5-ha (16-ac) Broadmore North Preserve is a conservation area that was set aside as mitigation by the Bellvue School District. It is also managed by CDFG. The two breeding sites are contiguous and encompass 30 ha (75 ac) containing three breeding pools. The FEMA Preserve has two large, deep pools that remain ponded late in the season. Salamanders probably breed there during most years. The one breeding pool on Broadmore North is shallow and does not contribute salamanders to the population in dry years (*i.e.*, there is no recruitment) (D. Cook, pers. comm., 2001). While there is no hydrological connection between this site and the deeper pools contained on the FEMA Preserve, the FEMA Preserve probably allows the salamanders at the Broadmore North Preserve the opportunity to breed during dry years. Urban development has occurred to the north and east sides of the preserves. Although these breeding sites are protected, urbanization imperils upland habitats on private land to the east and west of them. A new road and housing development on lands adjacent to the