Federal Register

Wednesday,
August 6, 2003

Part II

Department of the Interior

Fish and Wildlife Service

50 CFR Part 17

Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon; Final Rule

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

RIN 1018–AI26

Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: We, the Fish and Wildlife Service (Service), designate critical habitat pursuant to the Endangered Species Act of 1973, as amended (Act), for 4 vernal pool crustaceans and 11 vernal pool plants. A total of approximately 1,184,513 ac (417,989 ha) of land falls within the boundaries of designated critical habitat. This estimate reflects the exclusion of National Wildlife Refuge lands and National fish hatchery lands (33,097 ac (13,238 ha)), and State lands within ecological reserves and wildlife management areas (20,933 ac (8,373 ha)) from the final designation. However, the area estimate does not reflect the exclusion of lands within the following California counties: Butte, Madera, Merced, Sacramento, and Solano from the final designation pursuant to section 4(b)(2) of the Act.

This critical habitat designation requires us to consult under section 7 of the Act with regard to actions authorized, funded, or carried out by a Federal agency. Section 4 of the Act requires us to consider economic and other relevant impacts when specifying any particular area as critical habitat. We solicited data and comments from the public on all aspects of the proposed rule, including data on economic and other impacts of the designation.

DATES: This final rule is effective September 5, 2003.

ADDRESSES: Comments and materials received, as well as supporting documentation used in the preparation of this final rule, will be available for public inspection, by appointment, during normal business hours at the Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, 2800 Cottage, Room W–2605, Sacramento, CA 95825.

FOR FURTHER INFORMATION CONTACT: Arnold Roessler or Jan Knight, at the Sacramento Fish and Wildlife Office address above (telephone 916/414–6600; facsimile 916/414–6710).

SUPPLEMENTARY INFORMATION:

Preamble

Designation of Critical Habitat Provides Little Additional Protection to Species

In 30 years of implementing the ESA, the Service has found that the designation of statutory critical habitat provides little additional protection to most listed species, while consuming significant amounts of conservation resources. The Service's present system for designating critical habitat is driven by litigation rather than biology, limits our ability to fully evaluate the science involved, consumes enormous agency resources, and imposes huge social and economic costs. The Service believes that additional agency discretion would allow our focus to return to those actions that provide the greatest benefit to the species most in need of protection.

Role of Critical Habitat in Actual Practice of Administering and Implementing the Act

While attention to and protection of habitat is paramount to successful conservation actions, we have consistently found that, in most circumstances, the designation of critical habitat is of little additional value for most listed species, yet it consumes large amounts of conservation resources. Sidle (1987) stated, ''Because the ESA can protect species with and without critical habitat designation, critical habitat designation may be redundant to the other consultation requirements of section 7.''

Currently, only 306 species or 25 percent of the 1,211 listed species in the U.S. under the jurisdiction of the Service have designated critical habitat. We address the habitat needs of all 1,211 listed species through conservation mechanisms such as listing, section 7 consultations, the Section 4 recovery planning process, the Section 9 protective prohibitions of unauthorized take, Section 6 funding to the States, and the Section 10 incidental take permit process. The Service believes that it is these measures that may make the difference between extinction and survival for many species.

Procedural and Resource Difficulties in Designating Critical Habitat

We have been inundated with lawsuits regarding critical habitat designation, and we face a growing number of lawsuits challenging critical habitat determinations once they are made. These lawsuits have subjected the Service to an ever-increasing series of court orders and court-approved settlement agreements, compliance with which now consumes nearly the entire listing program budget. This leaves the Service with little ability to prioritize its activities to direct scarce listing resources to the listing program actions with the most biologically urgent species conservation needs.

The consequence of the critical habitat litigation activity is that limited listing funds are used to defend active lawsuits and to comply with the growing number of adverse court orders. As a result, the Service's own proposals to undertake conservation actions based on biological priorities are significantly delayed.

The accelerated schedules of court ordered designations have left the Service with almost no ability to provide for additional public participation beyond those minimally required by the APA, the Act, and the Service's implementing regulations, or to take additional time for review of comments and information to ensure the rule has addressed all the pertinent issues before making decisions on listing and critical habitat proposals, due to the risks associated with noncompliance with judicially imposed. This in turn fosters a second round of litigation in which those who will suffer adverse impacts from these decisions challenge them. The cycle of litigation appears endless, is very expensive, and in the final analysis provides little additional protection to listed species.

The costs resulting from the designation include legal costs, the cost of preparation and publication of the designation, the analysis of the economic effects and the cost of requesting and responding to public comment, and in some cases the costs of compliance with NEPA, all are part of the cost of critical habitat designation. These costs result in minimal benefits to the species that is not already afforded by the protections of the Act enumerated earlier, and they directly reduce the funds available for direct and tangible conservation actions.

Background

On the basis of the final economic analysis and other relevant impacts, as outlined under section 4(b)(2) of the Act, certain exclusions have been made, as detailed below. Because of the settlement agreement that requires us to deliver this rule to the **Federal Register** by July 15, 2003, there was insufficient time to revise the rule to fully reflect these exclusions. A technical amendment to the rule to take these areas out of the maps and legal descriptions, as well to change all the

appropriate references in the text of this preamble will be completed as soon as funding allows.

The following counties are excluded from this rule under Section 4(b)(2): Butte, Madera, Merced, Solano, and Sacramento. We find that the benefits of excluding these areas from critical habitat outweigh the benefits of including them. See further discussion under the Section 4(B)(2) analysis subheading below.

Vernal pool crustaceans and plants live in vernal pools (shallow depressions that hold water seasonally), swales (shallow drainages that carry water seasonally), and ephemeral (short-lived) freshwater habitats. None are known to occur in riverine waters, marine waters, or other permanent bodies of water. The vernal pool habitats of the 4 vernal pool crustaceans and 11 plants addressed in this final rule have a discontinuous distribution west of the Sierra Nevada that extends from southern Oregon through California into northern Baja California, Mexico (Holland and Jain 1978, 1988; Eriksen and Belk 1999).

Vernal pools are a unique kind of wetland ecosystem. Central to their distinctive ecology is that they are vernal or ephemeral, occurring temporarily—typically during the spring following fall and winter rains—and then disappearing until the next year. They are wet long enough to be different in character and species composition from the surrounding upland habitats, and yet their prolonged annual dry phase prevents the establishment of species typical of more permanent wetlands. In California, where extensive areas of vernal pool habitat developed over long periods of time, unique suites of species specially adapted to the unusual conditions of vernal pools have evolved. Fish and other predators are among the species excluded by vernal pools' annual drying, so vernal pool communities have developed and flourished in the absence of many predators. California vernal pools are also renowned for their showy displays of wildflowers, blooming in concentric rings about the pools in spring.

Many areas in California and portions of southern Oregon have the combination of environmental conditions that favor the development of vernal pools (Keeley and Zedler 1998). The climate is of a type classified as Mediterranean, with a wet season when rainfall exceeds evaporation, filling the pools, and a dry season when evaporation is greater, drying the pools. Rainfall is relatively meager even in most wet seasons, so erosion by overflowing waters does not dissect the topographic irregularities that form vernal pool basins. Temperatures during the fall and winter wet season are mild, so plants and animals can grow, mature, and reproduce.

A second major factor in the development of vernal pools is soil. Vernal pools form where there is a soil layer below or at the surface that is impermeable or nearly impermeable to water (Smith and Verrill 1998). Precipitation and surface runoff become trapped or ''perched'' above this layer. In California, the restrictive soil layers underlying vernal pools are of four main types: hardpans, claypans, volcanic flows, and non-volcanic rock. Hardpans are formed by leaching, redeposition, and cementing of silica minerals from high in the soil profile to a lower (''B'') horizon (Hobson and Dahlgren 1998; Smith and Verrill 1998). Claypans are formed by another redeposition process—fine clay particles are transported to the B horizon and accumulate there. Claypans may also be augmented by redeposition of saline or alkaline compounds. Hardpans and claypans both develop gradually over thousands of years, and can be a yard (meter) or more thick. Smith and Verrill (1998) list many of the soil series associated with vernal pools in the Central Valley. Volcanic flows include basaltic lavas and cemented mudflows, and are most common along the lower western slope of the Sierra Nevada. The soil parent material underlying vernal pools greatly influences species composition and hydrologic functioning of the vernal pool (Hanes and Stromberg 1998; Smith and Verrill 1998). Soils beneath vernal pools are extremely variable and may not be the same as soils mapped by soil surveys (Holland and Dain 1990).

A third factor, related to soil and climate, is topography or relief. Vernal pools typically occur in landscapes that, on a broad scale, are shallowly sloping or nearly level, but on a fine scale may be quite bumpy. Complex microrelief results in shallow, undrained depressions that form vernal pools. Some vernal pool landscapes are dotted with numerous rounded soil mounds known as mima mounds (Scheffer 1947). From the air, vernal pool landscapes often show characteristic patterning, produced by plant responses to mound and trough microrelief. This patterning has allowed mapping of vernal pool habitats throughout California's Central Valley and adjacent coastal foothill areas to a scale between 10 and 40 acre units (Holland 1998, 2003).

Vernal pools come in a variety of shapes and sizes, from less than a square yard (1 meter) to 2.5 ac (1 ha) or more. Some larger vernal wetlands, such as the 90 ac (36 ha) Olcott Lake in the Jepson Prairie Preserve in Solano County, are also referred to as playa pools or lakes. Playa pools with high alkalinity are termed alkali sinks. These larger wetlands contain many of the same animals and plants of smaller vernal pools, including many rare, threatened, and endangered species.

Since appropriate combinations of climate, soil, and topography often occur over continuous areas rather than in isolated spots, vernal pools in California, particularly in the Central Valley, tend to occur in clusters called ''complexes.'' A landscape that supports a vernal pool complex is typically a grassland, with areas of obstructed drainage that form the pools. Vernal pools can also be found in a variety of other habitats, including woodland, desert, chaparral, or pine forest. The pools may be fed or connected by low drainage pathways called ''swales.'' Swales are often themselves seasonal wetlands that remain saturated for much of the wet season, but may not be inundated long enough to develop strong vernal pool characteristics. Swales, due to their connection to adjacent pools, are considered part of the vernal pool complex.

Vernal pools begin to fill with the fall and winter rains. Before ponding occurs, there is a period during which the soil is wetted and the local water table may rise. Some pools have a substantial watershed that contributes to their water inputs; others may fill almost entirely from rain falling directly into the pool (Hanes and Stromberg 1998). Although exceptions are not uncommon, the watershed generally contributes more to the filling of larger or deeper pools, especially playa pools. Even in pools filled primarily by direct precipitation, Hanes and Stromberg (1998) report that subsurface inflows from surrounding soils can help dampen water level fluctuations during late winter and early spring. Vernal pools exhibit four major phases: (1) The wetting phase, when vernal pool soils become saturated; (2) the aquatic phase, when a perched water table develops and the vernal pool contains water; (3) a water-logged drying phase, when the vernal pool begins losing water as a result of evaporation and loss to the surrounding soils but soil moisture remains high; and (4) the dry phase, when the vernal pool and underlying soils are completely dry (Keeley and Zedler 1998). Upland areas associated with vernal pools are also an important source of nutrients to vernal pool organisms (Wetzel 1975). Vernal pool

habitats derive most of their nutrients from detritus (decaying matter) washed into pools from adjacent uplands, and these nutrients provide the foundation for a vernal pool aquatic community's food chain. Detritus is a primary food source for the vernal pool crustaceans addressed in this rule (Eriksen and Belk 1999). Because vernal pools are mostly rain-fed, they tend to have low nutrient levels and dramatic daily fluctuations in pH, dissolved oxygen, and carbon dioxide (Keeley and Zedler 1998).

Both the amount and timing of rainfall in California and Oregon vary greatly from year to year. As a result, pools may fill to different extents at different times. The duration of ponding of vernal pools also varies, and in certain years some pools may not fill at all. Many characteristics of vernal pool plants and animals result from these organisms' adaptations to the highly variable and unpredictable nature of vernal pools (Holland 1976; Holland and Dains 1990; King *et al.* 1996; Hanes and Stromberg 1998).

Compared to vernal pools worldwide, vernal pools in California and Oregon are rich in species composition and contain many species that are endemic to the region (found nowhere else). In addition, while most of California's grasslands are now dominated by nonnative grasses and other introduced plants, vernal pools remain a haven for native species. Invasive nonnative plants have been introduced into California and have spread and reproduced in upland habitats so successfully that it is not unusual for nonnatives to account for a third of the species and more than 90 percent of the biomass in a California grassland. Vernal pools have dramatically resisted this invasion: 75 to 95 percent of plant species found in vernal pools are native, and natives dominate in biomass as well as in number (Holland and Jain 1978; Jokerst 1990; Spencer and Rieseberg 1998). Vernal pool plant communities are able to resist invasion of upland species because of the severe ecological constraints on plants living in vernal pool environments.

The animal communities that live in vernal pools also contain diverse groups of highly specialized species. The freshwater crustacean communities of vernal pools are particularly well developed (Simovich 1998). The most visible crustaceans in vernal pools are the large branchiopods (literally, ''gill-foots''), about 27 species in California, of which perhaps 10 are endemic (Helm 1998; Belk and Fugate 2000) and 6 are federally listed as threatened or endangered. The large branchiopods are easily visible to the naked eye, ranging up to 2 inches (in) (5 centimeters (cm)) in length, depending on the species. They include the fairy shrimps (Anostraca), tadpole shrimps (Notostraca), and clam shrimps (Spinicaudata and Laevicaudata). Smaller crustaceans that are common in California vernal pools, many large enough to see without magnification, are water fleas (Branchiopoda-Cladocera), copepods (Copepoda), and seed shrimp (Ostracoda).

Amphibians and many insect species also live in vernal pools. The Pacific tree frog (*Hyla* (*Pseudacris*) *regilla*) and western toad (*Bufo boreas*) are common and abundant in and around vernal pools. Two rarer amphibians native to vernal pools are the California tiger salamander (*Ambystoma californiense*) and the western spadefoot toad (*Scaphiopus* (*Spea*) *hammondii*) (Morey 1998). While dispersing bullfrogs (Rana *catesbeiana*), which are not native to California, are sometimes found in vernal pools, they do not successfully breed there because bullfrog tadpoles require 2 years to mature and cannot survive the dry season. These voracious introduced predators will sometimes be found resting and feeding in vernal pools close to more permanent water, frequently associated with human modifications of the landscape. Fish likewise do not inhabit vernal pools, except where temporarily introduced by humans (*e.g.*, mosquitofish (Gambusia sp.)) or by flooding of permanent waters.

The insect fauna of vernal pools is numerous, varied, and primarily native, including aquatic beetles (Coleoptera-Dytiscidae, Hydrophilidae, Gyrinidae, Halipidae, Hydraenidae); aquatic bugs, including backswimmers (Hemiptera-Notonectidae), water boatmen (Corixidae), water striders (Gerridae), springtails (Collembola), mayflies (Ephemeroptera), dragonflies, and damselflies (Odonata); and various flies with aquatic larvae, including midges (Diptera-Chironomidae), crane flies (Tipulidae) and mosquitoes (Culicidae). Rogers (1998) found that mosquitoes made up less than 2 percent of the total macroscopic invertebrate population in natural and 2-year-old constructed pools, perhaps because many of the other insects listed above are predators. Vernal pool crustaceans are an important food source for a number of aquatic and terrestrial species. Aquatic predators include insects such as backswimmers (Family Notonectidae) (Woodward and Kiesecker 1994), predaceous diving beetles and their larvae (Family Dystictidae), and dragonflies and damselfly larvae (Order Odonate). Vernal pool tadpole shrimp are another significant predator of fairy shrimp (*Branchinecta* spp.).

The plants, invertebrate and vertebrate animals of vernal pools, and vernal pool landscapes in general are important providers of food and habitat for waterfowl, shorebirds, wading birds, toads, frogs, and salamanders (Proctor *et al.* 1967; Krapu 1974; Swanson 1974; Morin 1987; Simovich *et al.* 1991; Silveira 1996). During the spring, waterfowl feed on vernal pool crustaceans and other invertebrates, which are sources of protein and calcium needed for migration and egg-laying (Proctor *et al.* 1967; Silveira 1998). Vernal pool complexes contribute to continuity of wetland habitats along the Pacific Flyway (a major bird migration route). Many species feed or nest near vernal pools; for example, cliff swallows (*Hirundo fulva*) glean mud from vernal pool beds for their nests, lesser nighthawks (*Chordeiles acutipennis*) nest in dry vernal pool beds, burrowing owl (*Athene cunicularia*) and gopher (*Thomomys* spp.) burrows are found in mima mounds, and many species graze or hunt along vernal pool shorelines. Before their populations were nearly eliminated by hunting and habitat alteration, elk (Cervus spp.) and pronghorn antelope (*Antilocarpa americana*) undoubtedly grazed vernal pool landscapes, and have been replaced by cattle. There is additionally evidence that Native Americans in California's Central Valley used vernal pool crustaceans as a food source (Silveira 1998). Fishing net weights found near vernal pools suggest that California's first human populations also made use of vernal pool resources, as do hunters today (Silveira 1998).

Classification of Vernal Pools

The variability of vernal pool types has led many researchers to try and classify these ephemeral habitats. (Holland 1986; Sawyer and Keeler-Wolf 1995; Ferren *et al.* 1996; Smith and Verrill 1998). Most of these efforts have focused on classifying vernal pools based on the factors that influence variation in their physical features. Primary physical features that influence vernal pool size, depth, and soil and water chemistry include soil type, geologic formation, and landform. Landforms are physical attributes of the landscape resulting from geomorphological processes such as erosion and deposition, and include features such as alluvial terraces and basins and volcanic mudflows and lava flows.

The types and kinds of species that are found in vernal pools are largely

determined by these physical factors (Holland and Griggs 1976; Zedler 1987; Eng *et al.* 1990; Holland and Dains 1990; Simovich 1998). The physical characteristics of the vernal pool influence the life history characteristics of vernal pool species, such as the speed with which a species can mature and reproduce, the amount of soil moisture required for germination of plant seeds or hatching of invertebrate eggs or cysts, as well as tolerance to turbidity, total dissolved solids, and other aspects of vernal pool water chemistry.

Sawyer and Keeler-Wolf (1995) classified vernal pools according to a number of physical, geographic, and biological characteristics. They identified several general vernal pool types , each of which corresponds to the nature of the impermeable layer that underlies the particular vernal pool and assisted that pool to form. The vernal pool types were identified as Northern Hardpan, Northern Claypan, Northern Basalt Flow, Northern Volcanic Mudflow, and Northern Ashflow vernal pools. Northern Hardpan vernal pools are formed on alluvial terraces with silicate-cement soil layers. These pool types are on acidic soils and exhibit well-developed mima mound topography found on the eastern margins of the Central Valley. Northern Claypan vernal pools are formed on impermeable surfaces created by an accumulation of clay particles. These pool types are often found on basin and basin rim landforms and tend to occur in the central portion of the Central Valley and tend to be alkaline. Vernal pools identified as Northern Volcanic Mudflow, Northern Basalt Flow, and Northern Volcanic Ashflow are formed by an impervious bedrock layer of volcanic origin. These pool types are found on the eastern and coastal portions of the Central Valley, and tend to be small and restricted in distribution. Northern Basalt Flow vernal pools occur at greater elevations than other vernal pool types.

The vernal pools in Southern California are associated with several soil series types including but not limited to Huerheuero, Olivenhain, Placentia, Redding, and Stockpen (Bauder and McMillan 1998). These soil types and other similar soil series like other vernal pool bearing soils and geologic formations have a nearly impermeable surface or subsurface soil layer with a flat or gently sloping topography (Service 1998). Due to local topography and geology, the pools are usually clustered into pool complexes (Bauder 1986; Holland and Jain 1988). Pools within a complex are typically separated by distances on the order of meters, and may form dense, interconnected mosaics of small pools or a more sparse scattering of larger pools. The pools within the Santa Rosa Plateau in Riverside County, California are the only known locality for the Southern Basalt Flow Vernal Pools. Other vernal pools and pool complexes within the region, such as those at Skunk Hollow are not currently classified, but some of these pools converge on vernal lakes and others are associated with vernal alkali plains (Keeler-Wolf *et al.* 1998).

The vernal pools in the Agate Desert in Southern Oregon are located on alluvial fans capped with a shallow layer of clay loam over cemented hardpan. Other vernal pools within the area include those formed on older basaltic andesite formations such as those found on Table Rock. The vernal pool complexes are characterized by patterned ground with mounds and vernal pools. These pools vary in size from 1 to 30 m (3 to 100 ft) across, and attain a maximum depth of about 30 cm (12 in) (ONHP 1998). This landform is not true desert as it receives 48 cm (19 in) of precipitation annually. The pools within the area support the vernal pool fairy shrimp and other listed vernal pool species such as the endangered Cook's lomatium (*Lomatium cookii*) and large-flowered woolly meadowfoam (*Limnanthes floccosa* ssp. *grandiflora*) (Service 2002).

Vernal Pool Crustacean Background

All of the vernal pool crustacean species addressed in this critical habitat designation have evolved unique physical adaptations to survive in vernal pools. The timing and duration of wet and dry phases can vary significantly from year to year, and in some years, vernal pools may not inundate at all. In order to take advantage of the short inundation phase, vernal pool crustaceans have evolved short reproduction times and high reproductive rates. Most of the crustacean species addressed in this rule hatch within a few days after their habitats fill with water, and can start reproducing within a few weeks (Eng *et al.* 1990; Helm 1998; Eriksen and Belk 1999). Vernal pool crustaceans can complete their entire life cycle in a single season, and some species may complete several life cycles. Vernal pool crustaceans can also produce thousands of viable cysts when environmental conditions are favorable.

To survive the prolonged heat and dessication of the vernal pool dry phase, vernal pool crustaceans have developed a dormant stage. After vernal pool crustacean eggs are fertilized in the female's brood pouch, the embryos develop a thick, usually multilayered shell. When embryonic development reaches a late stage, further maturation stops, metabolism is drastically slowed, and the egg, now referred to as a cyst, enters a dormant state called diapause. The cyst is then either dropped to the pool bottom or remains in the brood sac until the female dies and sinks. Once the cyst is desiccated, it can withstand temperatures near boiling (Carlisle 1968), fire (Wells *et al.* 1997), freezing, and anoxic (deprived of oxygen) conditions without damage to the embryo. The cyst wall cannot be affected by digestive enzymes, and can be transported in the digestive tracts of animals without harm (Horne 1967). Most fairy shrimp cysts can remain viable in the soil for a decade or longer (Belk 1998).

Although the exact signals that cause crustacean cysts to hatch are unknown, factors such as soil moisture, temperature, light, oxygen, and osmotic pressure may trigger the embryo's emergence from the cyst (Brendonck 1996). Because the cyst contains a well-developed embryo, the animal can quickly develop into a fully mature adult. This allows vernal pool crustaceans to reproduce before the vernal pool enters the dry phase, sometimes within only a few weeks (Helm 1998; Eriksen and Belk 1999). In some species (*e.g.,* vernal pool tadpole shrimp), cysts may hatch immediately without going through a dormant stage, if they are deposited while the vernal pool still contains water. These cysts are referred to as quiescent, and their presence allows the vernal pool crustacean to produce multiple generations in a single wet season as long as their habitat remains inundated.

Another important adaptation of vernal pool crustaceans to the unpredictable conditions of vernal pools is the fact that not all of the dormant cysts hatch in every season. Simovich and Hathaway (1997) found that only 6 percent of San Diego fairy shrimp (*Branchinecta sandiegonensis*) cysts hatched after initial hydration, and only 0.18 percent of Riverside fairy shrimp (*Streptocephalus woottoni*) cysts hatched. The cysts that do not hatch remain dormant and viable in the soil. These cysts may hatch in a subsequent year and form a cyst bank much like the seed bank of annual plants. Based on a review of other studies (Belk 1977; Gallagher 1996; Brendonck 1996), Simovich and Hathaway (1997) concluded that species inhabiting more unpredictable environments, such as smaller or shorter lived pools, are more likely to have a smaller percent of their

cysts hatch after their vernal pool habitats fill with water. This strategy reduces the probability of complete reproductive failure if a vernal pool dries up prematurely. This strategy has been suggested as a mechanism by which rare species may persist in unpredictable environments (Chesson and Warner 1981; Chesson and Huntly 1989; Ellner and Hairston 1994).

Although the vernal pool crustaceans, and particularly the fairy shrimp, addressed in this rule are not often found in the same vernal pool at the same time, when coexistence does occur, it is generally in deeper, longer lived pools (Eng *et al.* 1990; Thiery 1991; Gallagher 1996; Simovich 1998). In larger pools, closely related species of fairy shrimp may coexist by hatching at different temperatures, and by developing at different rates (Thiery 1991; Hathaway and Simovich 1996). Vernal pool crustacean species may also be able to coexist by utilizing different physical portions of the vernal pool, or by eating different food sources (Daborn 1978; Hamer and Appleton 1991; Mura 1991; Thiery 1991).

The primary historic dispersal mechanisms for the vernal pool crustaceans probably consisted of large-scale flooding resulting from winter and spring rains and dispersal by migratory birds. As a result of widespread flood control and agricultural water diversion projects developed during the twentieth century, large scale flooding is no longer a major form of dispersal for the vernal pool crustaceans. When being dispersed by migratory birds, the eggs of these crustaceans are either ingested (Krapu 1974; Swanson 1974; Driver 1981; Ahl 1991) and/or they adhere to the bird's legs and feathers and are thereby transported to new habitats. Cysts may also be dispersed by a number of other species, such as salamanders, toads, cattle, and humans (Eriksen and Belk 1999).

The vernal pool crustaceans addressed in this rule are generally confined to habitats that are low to moderate in alkalinity and dissolved salts when compared with other aquatic systems (Eriksen and Belk 1999). Although potentially moderated by soil type, vernal pools are generally unbuffered and exhibit wide fluctuations in pH and dissolved oxygen (Keeley and Zedler 1998). Vernal pool water ion concentrations, such as sodium, potassium, calcium, chlorine, and magnesium, also experience large daily and seasonal variations. These variations are due to the concentration of ions as a result of evaporation, and the dilution of ions with additional rainfall throughout the wet season (Barclay and Knight 1981). How vernal pool crustacean species adapt to these fluctuations in water chemistry varies. Definitive conclusions on why the species has certain water chemistry habitat preferences is unknown due to the anecdotal nature of observations.

This final rule addresses four vernal pool crustaceans: the Conservancy fairy shrimp (*Branchinecta conservatio*), longhorn fairy shrimp (*Branchinecta longiantenna*), vernal pool fairy shrimp (*Branchinecta lynchi*) and the (*Lepidurus packardi*). Conservancy fairy shrimp , longhorn fairy shrimp, and vernal pool fairy shrimp are members of the aquatic crustacean order Anostraca, while the vernal pool tadpole shrimp is a member of the aquatic crustacean order Notostraca. Vernal pool fairy shrimp are found in California and southern Oregon, while the other three shrimp species are found only in California. These species have all evolved similar adaptations to the unique habitat conditions of their vernal pool habitats. The general appearance and life history characteristics of these four species will be described in combination below.

Conservancy fairy shrimp, longhorn fairy shrimp, and vernal pool fairy shrimp (fairy shrimp) have delicate elongate bodies, large stalked compound eyes, and 11 pairs of phyllopods, which are swimming appendages that also function as gills. They swim or glide gracefully upside down by means of complex beating movements that pass in a wavelike anterior-to-posterior direction. Fairy shrimp are filter feeders, and consume algae, bacteria, protozoa, rotifers, and bits of detritus as they move through the water. The second pair of antennae in fairy shrimp adult males are greatly enlarged and specialized for clasping the females during copulation. The females carry eggs in an oval or elongate ventral sac (brood pouch). Once fertilized, the eggs are coated (encysted) with a protective protein layer that allows them to withstand heat, cold, and prolonged dehydration. These dormant embryos are known as cysts. The cysts are either dropped to the pool bottom or remain in the brood pouch until the female dies and sinks. The cysts can remain viable in the soil for decades after deposition (Eriksen and Belk 1999). When the pools refill in the same or subsequent seasons, some but not all of the cysts may hatch (Eriksen and Belk 1999). The cyst bank in the soil may consist of cysts from several years of breeding. The cysts that hatch may do so within days after the vernal pools fill, and the hatchlings rapidly develop into adults within weeks. In pools that persist for several weeks to a few months, fairy shrimp may have multiple hatches during a single season.

Vernal pool tadpole shrimp have dorsal compound eyes, a large shieldlike carapace (shell) that covers most of their body, and a pair of long cercopods or appendages at the end of the last abdominal segment. They are primarily benthic (living on the bottoms of the pools) animals that swim with their legs down. Vernal pool tadpole shrimp climb or scramble over objects, and plow along bottom sediments as they forage for food. Their diet consists of organic detritus and living organisms, such as fairy shrimp and other invertebrates (Fryer 1987). The females disperse their fully developed cysts into the pool, where the cysts are then deposited into the sediment. Like fairy shrimp, vernal pool tadpole shrimp pass the summer months as dormant cysts in the soil. Some of the cysts hatch as the vernal pools are filled with rainwater in the next or subsequent seasons, while other cysts may remain dormant in the soil for many years. When winter rains refill inhabited pools, tadpole shrimp reestablish from dormant cysts and may become sexually mature within 3 to 4 weeks after hatching (Ahl 1991; Helm 1998). Mature adults may be present in pools until the habitats dry up in the spring (Ahl 1991; Gallagher 1996).

Additional information specific to each of the four individual vernal pool crustacean species described in this rule is provided below.

Conservancy Fairy Shrimp

Conservancy fairy shrimp were first described in 1990 by Eng, Belk, and Eriksen. The type specimens were collected in 1982 at Olcott Lake, Solano County, California. Conservancy fairy shrimp are currently known from only eight disjunct areas: Vina Plains and vicinity in southern Tehama and northern Butte County, Jepson Prairie in Solano County, Suisun Slough in southern Solano County, Sacramento National Wildlife Refuge in Glenn County, near Caswell Memorial State Park in Stanislaus County; Haystack Mountain Area in eastern Merced County, San Luis National Wildlife Refuge Complex in central Merced County, and the Mutau Flat area in the Los Padres National Forest area of northern Ventura County. Conservancy fairy shrimp are known from 18 occurrences (California Natural Diversity Database (CNDDB) 2002).

Conservancy fairy shrimp look similar to other fairy shrimp species, but can be distinguished by characteristics of the male second antenna. The second antennae of Conservancy fairy shrimp

males have a distal segment which is about 30 percent shorter than the basal segment, and has a tip bent medially about 90 degrees (Eng et al. 1990). The female brood pouch is tapered at each end, typically extends to abdominal segment 8, and has a terminal opening (Eng et al. 1990). Males may be from 0.6 to 1.0 in (14 to 27 millimeters (mm)) in length, and females have been measured between 0.6 and 1.0 in (14.5 and 23 mm) long.

Further discussion on the life history and habitat requirements of Conservancy fairy shrimp can be found in the final rule to list this species (59 FR 48136).

Longhorn Fairy Shrimp

Longhorn fairy shrimp were first collected in 1937, but were not formally described until 1990 by Eng, Belk, and Eriksen. The type specimen was collected from a sandstone outcrop pool on the Souza Ranch in Contra Costa County, California. Longhorn fairy shrimp are extremely rare, and are only known from three widely separated locations: the Altamont Pass area in Contra Costa and Alameda Counties, the western and northern boundaries of Soda Lake on the Carrizo Plain in San Luis Obispo County, and Kesterson National Wildlife Refuge in the San Joaquin Valley in Merced County. Vernal pool crustacean surveys conducted by Sugnet (1993) found only 3 occurrences of longhorn fairy shrimp out of 3,092 locations surveyed, and Helm (1998) found occurrences of longhorn fairy shrimp in only 9 of 4,008 wetlands sampled.

Longhorn fairy shrimp are distinguished from other fairy shrimp by the male's very long second antenna, which is about twice as long, relative to its body, as the second antenna of other species of *Branchinecta.* Longhorn fairy shrimp antennae range from 0.3 to 0.4 in (6.7 to 10.4 mm) in length (Eriksen and Belk 1999). Females can be recognized by their cylindrical brood pouch, which extends to below abdominal segments 6 or 7. Mature males have been measured between 0.5 to 0.8 in (12 and 21 mm) in length, and females range from 0.5 to 0.8 in (13.3 to 19.8 mm) in length (Eng et al. 1990).

Further discussion of the life history and habitat requirements of longhorn fairy shrimp can be found in the final rule to list this species (59 FR 48136).

Vernal Pool Fairy Shrimp

Vernal pool fairy shrimp were first described by Eng et al. in 1990 from a type specimen that was collected in 1982 at Souza Ranch, Contra Costa County, California. The species occurs in disjunct fragmented habitats distributed across the Central Valley of California from Shasta County to Tulare County and the central and southern coast ranges from northern Solano County to Ventura County, California. Additional disjunct occurrences have been identified in southern California and in Oregon. In Oregon, the species' distribution is limited to the vicinity of an approximately 32 square mile (mi2) 82.9 square kilometer (km2)) area known as the Agate Desert in Jackson County, north of Medford. In southern California, the distribution is equally limited, with populations occurring in three areas in Riverside County.

Vernal pool fairy shrimp are characterized by the presence and size of several bulges on the male's antenna, and by the female's short, pyriform or pear shaped brood pouch. Vernal pool fairy shrimp vary in size, ranging from 0.4 to 1.0 in (11 to 25 mm) in length (Eng et al. 1990).

Vernal pool fairy shrimp are currently found in 27 counties across the Central Valley and coast ranges of California, inland valleys of southern California, and southern Oregon. Although vernal pool fairy shrimp are distributed more widely than most other fairy shrimp species, they are generally uncommon throughout their range and rarely abundant where they do occur (Eng et al. 1990; Eriksen and Belk 1999).

Further discussion of the life history and habitat requirements of vernal pool fairy shrimp can be found in the final rule to list this species (59 FR 48136).

Vernal Pool Tadpole Shrimp

Vernal pool tadpole shrimp were initially described by Simon in 1886 and named *Lepidurus packardi.* After subsequent reclassification by Longhurst (1955), the species was given a subspecies status based primarily on the lack of apparent geographic boundaries between *L. apus* and *L. packardi* populations. Lynch (1972) resurrected *L. packardi* to full species status based on further examination of specimens, and this is the currently accepted taxonomic status of vernal pool tadpole shrimp. Vernal pool tadpole shrimp inhabit sites in California's Central Valley and San Francisco Bay area. The geographic range of this species includes disjunct occurrences found in the Central Valley from Shasta County to northern Tulare County, and in the central coast range from Solano County to Alameda County. Vernal pool tadpole shrimp are known from 160 occurrences (CNDDB 2001).

Vernal pool tadpole shrimp are distinguished by a large, shieldlike carapace, or shell, that covers the anterior half of their body. Vernal pool tadpole shrimp have 30 to 35 pairs of phyllopods, a segmented abdomen, paired cercopods or tail-like appendages, and fused eyes. Vernal pool tadpole shrimp will continue to grow as long as their vernal pool habitats remain inundated, in some cases for 6 months or longer. They periodically shed their shells, which can often be found along the edges of vernal pools where vernal pool tadpole shrimp occur. Mature vernal pool tadpole shrimp range in size from 0.6 to 3.4 in (15 to 86 mm) in length.

Vernal pool tadpole shrimp have relatively high reproductive rates. Ahl (1991) found that fecundity increases with body size. A large female greater than 0.8 in (20 mm) in carapace length could deposit as many as 6 clutches, averaging 32 to 61 eggs per clutch, in a single wet season.

Further discussion of the life history and habitat requirements of vernal pool tadpole shrimp can be found in the final rule to list this species (59 FR 48136).

Vernal Pool Plants Background

The 11 vernal pool plants described in this rule have developed a suite of highly specialized adaptations that allow them to survive in vernal pool habitats. All 11 species are annuals, meaning they germinate, grow, reproduce, and die within a single year. This allows the vernal pool plants to complete their life cycles during the relatively short inundation and drying periods of their vernal pool habitat.

Another adaptation of vernal pool plants is production of dormant seeds. This adaptation allows vernal pool plants to survive the hot summer months in the soil. The seeds may remain viable in the soil for many years. The number of plants present above ground may fluctuate dramatically from year to year. However, much of the population of these species exists as seeds in the soil. Vernal pool plant seeds germinate after winter rains in response to a complex set of environmental cues that are not well understood, but generally include various temperature and soil moisture. Not all of the dormant seeds will germinate in any given year. This strategy reduces the probability of local extirpation if environmental conditions change—for example, if a vernal pool dries up prematurely. It has also been suggested the strategy acts as a mechanism by which rare species may persist in unpredictable environments (Chesson and Warner 1981; Chesson and Huntly 1989; Ellner and Hairston 1994).

Tolerance to inundation differs greatly among species (Zedler 1987). Vernal pool plant zonation, in which characteristic rings of flowers form around vernal pools, is a result of this differential tolerance to inundation. Species that are the least tolerant to inundation grow along the margins of the pools, while those that can tolerate extended periods of inundation grow in the center of the pools.

Information for the vernal pool plants can be found in the final rules to list these species (62 FR 34029; 62 FR 14338; 57 FR 24192; 43 FR 44810) and in the criteria section of this rule. Additional information specific to each of the 11 individual vernal pool plant species described in this rule is provided below.

Limnanthes floccosa ssp. californica

Limnanthes floccosa ssp. *californica* (Butte County meadowfoam) was first collected in 1917 at a site 10 miles (mi) (16 kilometers (km)) north of Chico (Service 1991b), although it was recognized as a separate subspecies at that time. Kalin-Arroyo (1973) determined that it was a distinct taxon and gave it the scientific name *Limnanthes floccosa* ssp. *californica.* The type locality is in Butte County between Chico and Oroville, near the intersection of State Highway 99 and Shippee Road (Kalin-Arroyo 1973).

Limnanthes floccosa ssp. *californica* is a small annual of the meadowfoam or false mermaid family (Limnanthaceae). It has erect stems less than 10 in (25 cm) tall. The stem and leaves are densely pubescent (covered with short hairs). The alternate leaves are pinnately compound (divided into distinct segments which are arranged featherlike on either side of a rachis), up to 3 in (8 cm) long, and consist of 5 to 11 leaflets on a long petiole. A single flower arises in the axil (angle between the base of a leaf and the stem) of each upper leaf. The flowers are white with yellow veins, cup or bowl-shaped, and consist of 5 petals, 5 sepals, 5 pistils (female reproductive structures of a flower), and 10 stamens (male reproductive structures of a flower) on a long flower stalk (Kalin-Arroyo 1973; McNeill and Brown 1979; Ornduff 1993b).

Limnanthes floccosa ssp. *californica* has always been confined to small widely scattered occurrences in northwestern Butte County (Keeler-Wolf *et al.* 1998). In her original description, Kalin-Arroyo (1973) mentioned six collections, including the type locality. Five of those were in the areas ranging from the original collection site southeast to Oroville, and the sixth was from Table Mountain north of Oroville. However, James Jokerst (1983) did not find *L. f.* ssp. *californica* on Table Mountain and later suggested that the specimen had been misidentified (Service 1992a).

All 13 of the occurrences described by the California Natural Diversity Database (CNDDB) (2002) had been reported by 1988 (Kalin-Arroyo 1973; McNeill and Brown 1979; Dole 1988; Jokerst 1989). Five were in northern and northeastern Chico near the municipal airport, four (including the type locality) were from the area around Shippee (northwest of Oroville), and three were from southeastern Chico. The other occurrence, northeast of the town of Nord, contained only one plant that was of questionable identity (CNDDB 2002). However, the area indicated would be in the same vicinity as the 1917 collection.

Two occurrences of *Limnanthes floccosa* ssp. *californica* have been extirpated, one each in northern and southeastern Chico (Jokerst 1989; Dole and Sun 1992; Service 1992a; CNDDB 2002). Some of the other 11 extant occurrences have been reduced in distribution (CNDDB 2002).

Limnanthes floccosa ssp. *californica* normally is found in three types of seasonal wetland habitats: ephemeral drainages (swales), vernal pool depressions in swales, and occasionally around edges of isolated vernal pools (Jokerst 1989). The swales and vernal pools where *L. f.* ssp. *californica* grows are on intermediate fan terraces (Kelley and Associates Environmental Sciences 1992) in annual grasslands with mima mound topography. Large cobbles are present throughout the pools and swales (Jokerst 1989). These pools are associated with Tuscan, Redbluff, Riverbank, and Modesto geologic formations, and most of them occur on soils of the Tuscan-Anita and the Redding-Igo complexes. Anita and Igo soils are confined to the pools and swales. Tuscan and Redding soils are restricted to the mounds. The two soils are underlain by iron-silica cemented and indurated (hardened) hardpan, respectively (Kelley and Associates Environmental Sciences 1993). *Limnanthes floccosa* ssp. *californica* has been observed on Anita clay soils annually regardless of rainfall but appears on Igo soils only in years of above-average rainfall (Kelley and Associates Environmental Sciences 1992a; Crompton 1993; Schonholtz *in litt.* 1995), presumably because the former can hold approximately twice as much moisture (Kelley and Associates Environmental Sciences 1993). Confirmed occurrences have been found at 165 to 300 ft (50 to 90 m) in elevation (McNeill and Brown 1979; CNDDB 2002). The habitat associated with *L. f.* ssp. *californica* includes saturated soils and pools with a short lived inundation period.

Further discussion of the life history and habitat characteristics of *Limnanthes floccosa* ssp. *californica* can be found in the final rule to list the species (62 FR 54807).

Lasthenia conjugens

Edward Greene (1888) first described this species as *Lasthenia conjugens* (Contra Costa goldfields), from specimens collected near Antioch, California. Harvey Hall (1914) later lumped it in with *Baeria fremontii* (Fremont's goldfields). Roxana Ferris (1958) proposed the name *Baeria fremontii* var. *conjugens* to recognize the distinctiveness of *L. conjugens.* Finally, Robert Ornduff (1966) restored Greene's original name and rank, returning this species to the genus *Lasthenia.*

Lasthenia conjugens is a showy spring annual in the aster family (Asteraceae). Its stems are 4 to 12 in (10 to 30 cm) tall, somewhat fleshy, and usually are branched. The leaves are opposite and narrow; the lower leaves are entire, but stem leaves have one or two pairs of narrow lobes. The daisylike flower heads are solitary (Greene 1888; Ornduff 1993a).

Twenty extant occurrences of *Lasthenia conjugens* are found widely scattered in small vernal pool areas in Alameda, Contra Costa, Mendocino, Monterey, Napa, and Solano Counties. Of these 20 occurrences, Solano County has 11 small scattered occurrences in a general area east and south of the City of Fairfield. The Santa Barbara County and Santa Clara County occurrences of *L. conjugens* have probably been lost due to habitat alteration (CNDDB 2002). One Napa County site, Milliken Canyon, contained only a single plant in 1987 whether this individual is still in existence is unknown (CNDDB 2002).

Lasthenia conjugens typically grows in vernal pools, swales, moist flats, and depressions within a grassland matrix (CNDDB 2002). However, several historical collections were from populations growing in the saline-alkaline transition zone between vernal pools and tidal marshes on the eastern margin of the San Francisco Bay (Baye, Service, in litt. 2000a). The herbarium sheet for one of the San Francisco Bay specimens notes that the species also grew in evaporating ponds used to concentrate salt (Baye, in litt. 2000b). The vernal pool types from which this species has been reported are Northern Basalt Flow, Northern Claypan, and Northern Volcanic Ashflow (Sawyer and Keeler-Wolf 1995). The landforms and

geologic formations for sites where *L. conjugens* occurs have not yet been determined. Most occurrences are found at elevations of 6 to 200 ft (2 to 61 m), but the recently discovered Monterey County occurrences are at 400 ft (122 m), and one Napa County occurrence is at 1,460 ft (445 m) elevation (CNDDB 2002).

The soil types that maintain vernal pool habitats for *Lasthenia conjugens* have not yet been identified for most localities. The soil series from which this species is known are Aiken, Antioch, Concepcion, Conejo, Crispin, Haire, Linne, Los Robles, Rincon, Solano, and San Ysidro, plus the Arnold-Santa Ynez, Hambright-rock outcrop, and Los Osos complexes. Soil textures, where known, are clays or loams. At least in Solano County and on the shores of San Francisco Bay, *L. conjugens* grows in alkaline or saline-alkaline sites (Baye, in litt. 2000a, 2000b; CNDDB 2002).

Further discussion on the life history and habitat characteristics of *Lasthenia conjugens* can be found in the final rule to list the species (62 FR 33029; June 18, 1997).

Chamaesyce hooveri

Chamaesyce hooveri (Hoover's spurge) was originally named *Euphorbia hooveri* based on a specimen collected by Robert Hoover in Yettem, Tulare County (Wheeler 1940). Koutnik (1985) placed the species in the genus *Chamaesyce* as *C. hooveri.*

Chamaesyce hooveri is an annual herb of the spurge family (*Euphorbiaceae*). The species trails along the ground, forming gray-green mats 2 to 40 in (5 to 100 cm) in diameter (Broyles 1987, Stone *et al.* 1988). The stems are hairless and contain milky sap. The tiny (0.08 to 0.20 in (2 to 5 mm)) leaves are opposite, rounded to kidney-shaped, with an asymmetric base and a toothed margin. In the genus *Chamaesyce,* the structures that appear to be flowers actually are groups of flowers; each group is referred to as a cyathium (Koutnik 1993).

CNDDB (2002) includes 30 occurrences of *Chamaesyce hooveri.* Of these, one each in Tehama and Tulare Counties are classified as extirpated; two others, in Butte and Tehama Counties, may no longer occur because this species was not observed for 2 consecutive years (Stone *et al.* 1988; CNDDB 2002). The Vina Plains of Tehama and Butte Counties contain 14 (54 percent) of the 26 extant occurrences of *C. hooveri* (CNDDB 2002) in an area approximately 35 mi^2 (91 km^2) in size (Stone *et al.* 1988). One other site in the same region is near Chico in Butte County. Seven of the 26 extant occurrences are in the Southern Sierra Foothills Vernal Pool Region, including 5 in the Visalia-Yettem area of Tulare County and 2 in the Hickman-La Grange area of Stanislaus County. Three other occurrences are on the Sacramento National Wildlife Refuge in Glenn County, which is in the Solano-Colusa Vernal Pool Region. The one other extant occurrence is on the Bert Crane Ranch in Merced County, which is within the San Joaquin Valley Vernal Pool Region (Keeler-Wolf *et al.* 1998; CNDDB 2002).

Vernal pools from which *Chamaesyce hooveri* has been reported are classified as Northern Hardpan and Northern Claypan vernal pools (Sawyer and Keeler-Wolf 1995). The pools supporting this species vary in size from 0.47 to 600 ac (0.19 to 243 ha), with a median area of 1.43 ac (0.58 ha) (Stone *et al.* 1988). Many occurrences consist of multiple pools that vary in area and depth, yet not all pools at a site support *C. hooveri.* Deeper pools apparently provide better habitat for this species because the duration of inundation is longer. This species may occur along the margins or in the deepest portions of the dried pool bed (Stone *et al.* 1988; Alexander and Schlising 1997). A particularly important feature of *C. hooveri* microhabitat, at least in the deeper pools, is that it is nearly devoid of other vegetation, and thus competition from other plants is reduced (Stone *et al.* 1988).

Vernal pools supporting *Chamaesyce hooveri* occur mostly on alluvial fans or terraces of ancient rivers or streams, with a few on the rim of the Central Valley basin. It is found on a wide variety of soils, ranging in texture from clay to sandy loam. Soil series include Anita, Laniger, Lewis, Madera, Meikle, Riz, Tuscan, Whitney, and Willows. All of these soils may not equally support the habitat requirements for this species, however. For example, in one Vina Plains pool, *C. hooveri* grew primarily in the portion that was underlain by Tuscan loam, but were nearly absent from the portion underlain by Anita clay (Alexander and Schlising 1997).

In the Sacramento Valley, occupied pools are on acidic soils over iron-silica cemented hardpan. Most pools supporting *Chamaesyce hooveri* in the San Joaquin Valley are on neutral to saline-alkaline soils over lime-silica cemented hardpan or claypan (Broyles 1987; Stone *et al.* 1988; Sawyer and Keeler-Wolf 1995; CNDDB 2002). Occurrences have been reported from elevations ranging from 85 ft (26 m) in Glenn County to 420 ft (128 m) in Tehama County (CNDDB 2002).

Further discussion on the life history and habitat characteristics of *Chamaesyce hooveri* can be found in the final rule to list the species (62 FR 14338).

Castilleja campestris ssp. *succulenta*

Robert Hoover (1936a) first described this species as *Orthocarpus campestris* var. *succulentus* (fleshy owl's-clover). The type specimen had been collected at Ryer, in Merced County. Robert Hoover (1968) subsequently raised its rank and assigned it the name *Orthocarpus succulentus.* Chuang and Heckard (1991) reconsidered the taxonomy of *Orthocarpus* and related genera. Based on floral morphology (external structure or form), seed morphology, and chromosome number, they transferred many species into the genus *Castilleja.* Furthermore, they determined that the appropriate rank for this species was as a subspecies of *Castilleja campestris* (field owl's-clover) and assigned the plant the scientific name *Castilleja campestris* ssp. *succulenta* (Chuang and Heckard 1991).

Castilleja campestris ssp. *succulenta* is a hemiparasitic (partly parasitic) annual herb belonging to the snapdragon family (Scrophulariaceae). The plant has erect or decumbent (laying on the ground with the tip turned upward) stems up to 12 in (30 cm) long. The stems are usually unbranched and without hairs. The leaves at the base of the stem are small and scalelike, whereas those on the upper stem are lance-shaped, not lobed, thick, fleshy, brittle, and easily broken. The bracts (leaf-like structures in the flowering structure) are green, similar to but shorter than the upper leaves, and longer than the flowers. Overall, the inflorescence (entire flowering structure of a plant) may occupy as much as half of the plant's height (Hoover 1936a, 1937, 1968; Chuang and Heckard 1991, 1993).

Castilleja campestris ssp. *succulenta* is known from 63 widely scattered extant occurrences in vernal pool habitats along the Southern Sierra Foothills Vernal Pool Region ranging from Madera County to a disjunct occurrence in northern San Joaquin County. *Castilleja campestris* ssp. *succulenta* is known from 11 occurrences in Fresno County, 9 in Madera, 36 in Merced, 5 in Stanislaus and 1 in Tuolumne (Keeler-Wolf *et al.* 1998; CNDDB 2002).

Castilleja campestris ssp. *succulenta* is known mostly from vernal pools occurring on alluvial terrace landforms. These pool types have been described as both Northern Claypan and Northern Hardpan vernal pools (Sawyer and

Keeler-Wolf 1995) within annual grassland communities (CNDDB 2002). However, it is found on Northern Basalt Flow vernal pools on Hideaway soils series at one location in the San Joaquin Valley. It is known from both small and large pools (EIP Associates 1999). Although not all pools occupied by this taxon have been studied in detail, Stebbins *et al.* (1995) collected data on six occupied pools in Fresno and Madera Counties. Some were typical ''bowl-like'' pools, whereas others were more similar to swales. This subspecies has been reported from pools with both long and short inundation periods (EIP Associates 1999), and from both shallow and ''abnormally deep vernal pools,'' but approximate depth of these pools was not given (CNDDB 2002).

Soil series supporting *Castilleja campestris* ssp. *succulenta* include Amador, Anderson, Corning, Fallbrook, Keyes, Pentz, Ramona, Redding, San Joaquin, Vista, and Yokohl, as well as the Pollasky-Montpellier complex. Soil textures at those sites range from extremely stony loam to loamy clay. In the proposed University of California-Merced campus and community area, the species is found primarily on Redding gravelly loam; however, Corning, Keyes, and Pentz soils also contain occurrences of the species (EIP Associates 1999). Occurrences of *C. c.* ssp. *succulenta* have been reported from elevations of 80 ft (24 m) at the San Joaquin County site to 2,300 ft (700 m) at Kennedy Table in Madera County (CNDDB 2002). We are uncertain about specific soils that may correlate with the presence of this species, although it is irregularly found on Redding soil series. Vernal pool complexes that provide habitat for this species include pools ranging in depth from 6 in (15 cm) to 10 in (25 cm), but the species is also found less frequently in shallower and deeper pools. Soil pH values for some of the vernal pools in Merced County occupied by *C. c.* ssp. *succulenta* range from 4.3 to 6.2. Although no comprehensive study has been conducted, some vernal pools occupied by *C. c.* ssp. *succulenta* vary in size from 0.02 ac (81 m^2) to 0.12 ac (486 m^2) in Merced County. Merced County contains the largest aggregations of *C. c.* ssp. *succulenta:* occurrences are found on mild to strongly acidic soils on Laguna, Mehrten, North Merced Gravels, and Riverbank Formations, as well as on Ione, Mehrten, and Valley Springs geological formations. The parent material of vernal pools greatly influences species composition and hydrologic functioning of the vernal pool (Holland and Jain 1981, 1988; Hanes and Stromberg 1998). *Castilleja campestris* ssp. *succulenta* appears to prefer the more-weathered acidic, higher-terrace vernal pool complexes that are composed of volcanic tuff sand quartzite parent materials.

Further discussion on the life history and habitat characteristics of *Castilleja campestris* ssp. *succulenta* can be found in the final rule to list the species (62 FR 14338).

Orcuttieae Tribe

Neostapfia colusana (Colusa grass), *Orcuttua pilosa* (hairy Orcutt grass), *Tuctoria mucronata* (Solano grass), *Tuctoria greenei* (Greene's tuctoria), *Orcuttia viscida* (Sacramento Valley Orcutt grass), *Orcuttia inaequalis* (San Joaquin Valley Orcutt grass), and *Orcuttia tenuis* (slender Orcutt grass) belong to the tribe Orcuttieae in Poaceae, the grass family, (Reeder 1965). Many life history characteristics are common to all members of the Orcuttieae. All are wind pollinated, but pollen may not be carried long distances between occurrences (Griggs 1980,1981; Griggs and Jain 1983). Local seed dispersal is by water, which breaks up the inflorescence (Reeder 1965; Crampton 1976; Griggs 1980, 1981). Long-distance dispersal is unlikely (Service 1985c), but seed may have been carried occasionally by waterfowl (family Anatidae), tule elk (*Cervus elaphus nannoides*), or pronghorn (*Antilocapra americana*) in historical times (Griggs 1980). The seeds can remain dormant for an undetermined length of time, but at least for 3 or 4 years, and germinate underwater after they have been immersed for prolonged periods (Crampton 1976; Griggs 1980; Keeley 1998a). Unlike typical terrestrial grasses that grow in the uplands surrounding vernal pools, members of the Orcuttieae flower during the summer months (Keeley 1998a).

Members of the Orcuttieae tribe share a suite of characteristics that separate the genera within the tribe from all other grasses and have no close terrestrial relative tribes. The semi-aquatic annual plants in this distinct group contain glands that produce a viscid aromatic exudate (sticky aromatic substance) exhibit no distinction between the leaf blade and blade sheath, lack leaf ligules (small membranous appendages at the base of a leaf), and possess small sunken mushroom-shaped bicellular microhairs. These seasonally submerged species germinate and grow as submerged aquatic plants for several weeks to 3 months. With the exceptions of *Tuctoria* and the variable aquatic and terrestrial leaves of *Neostapfia, Orcuttia* species produce floating aquatic juvenile leaves that lack stomata (openings for gas exchange). These partly amphibious *Orcuttia* species within this tribe replace their juvenile leaves with terrestrial leaves as the vernal pools dry out.

All members of the Orcuttieae tribe have large soil seed banks that may be 50 times (or more) larger in numbers than the aboveground population in any given year. In general, years of above-average rainfall promote larger expressions of occurrences of Orcuttieae, but occurrence responses vary by pool and by species (Griggs 1980; Griggs and Jain 1983). Population sizes have been observed to vary by one to four orders of magnitude among successive years and return to previous levels even after 3 to 5 consecutive years when no mature plants were present (Griggs 1980; Griggs and Jain 1983; Holland 1987). Thus, many years of observation are necessary to determine whether any occurrence of a species is increasing, stable, or declining.

Eight members of the Orcuttieae tribe are endemic and restricted to vernal pools in California. The Orcuttieae tribe contains the three genera *Neostapfia, Orcuttia*, and *Tuctoria*. The genus Neostapfia contains one species, *Neostapfia colusana*. The genus *Orcuttia* has five species and *Tuctoria* has two species. Although the various species within the tribe have been found in vernal pools ranging widely in size, the vast majority are found within vernal pools of 0.03 ac (0.01 ha) to 24.7 ac (10 ha) (Stone *et al.* 1988). Larger vernal pools retain water until May or June, creating optimal conditions for Orcuttieae (Crampton 1959; Crampton 1976; Griggs 1981; Griggs and Jain 1983). Orcuttieae usually occur in patches within the pools that are essentially devoid of other plant species (Crampton 1959, 1976). Typically, these plants near the center of a vernal pool grow larger and produce more spikelets than those near the margins, but patterns vary depending on individual pool characteristics and seasonal weather conditions (Griggs 1980).

A discussion of each of the seven Orcuttieae species in this rule is provided below. The number of subject extant occurrences of the 3 genera within the tribe total 219, and an additional 80 occurrences have been extirpated or are considered possibly extirpated by intensive agriculture, land use conversions, urban development, and other factors (CNDDB 2002).

Neostapfia colusana

Joseph Burtt-Davy (1898) first described *Neostapfia colusana* (Colusa grass) and gave the Latin name *Stapfia*

colusana. He collected the type specimen near the town of Princeton in Colusa County, but soon realized that the name *Stapfia* had already been assigned to a genus of green algae, and thus changed the scientific name to *Neostapfia colusana* (Davy 1899). Two other taxonomists proposed alternate Latin names for the genus in the same year, but neither is accepted today. There are no other known species of *Neostapfia* (Reeder 1982, 1993).

Currently, CNDDB (2002) considers 41 occurrences of *Neostapfia colusana* to be extant and 19 other occurrences to no longer exist or to be possibly extirpated. Of the 41 extant occurrences, 23 occurrences of *N. colusana* are found in Merced County and 14 occurrences exist east of Hickman in Stanislaus County. Two occurrences each are found in southeastern Yolo County in central Solano County (Stone *et al.* 1988; Keeler-Wolf *et al.* 1998; CNDDB 2002). This species has been extirpated from Colusa and Glenn Counties (CNDDB 2002).

Neostapfia colusana occurs on the rim of alkaline basins in the Sacramento and San Joaquin Valleys, as well as on acidic soils of alluvial fans and stream terraces along the eastern margin of the San Joaquin Valley and into the adjacent foothills (Stone *et al.* 1988). *Neostapfia colusana* has been found in Northern Claypan and Northern Hardpan vernal pool types (Sawyer and Keeler-Wolf 1995) within rolling grasslands (Crampton 1959). This species typically grows in the deepest portion of the pool (Crampton 1959), but may also occur on the margins (Hoover 1937; Stone *et al.* 1988). Deeper pools are most likely to provide the long inundation period required for germination (EIP Associates 1999). It appears to favor somewhat larger vernal pools that are shallower as compared to other vernal pool plants. *Neostapfia colusana* occurrences vary in elevation from near 16 ft (5 m) to near 350 ft (100 m).

Vernal pool complexes that provide habitat for this species include two different physiographic and edaphic settings: (1) claypan soils of saline-alkali basins and remnant alluvial fans and (2) old stream terrace areas with strongly acidic, gravelly, and cobbly soils having an iron-silica cemented hardpan and shallow, slightly acidic residual soils of the Pentz series underlain by cemented tuffaceous alluvium. Additional settings for *Neostapfia colusana* are found in vernal pool complexes where resistant beds of tuffaceous deposits are exposed along intermittent drainages and, in Stanislaus County, neutral-to-slightly-alkaline claypan soils on dissected alluvial fans. Not all areas of *N. colusana* have been identified as to the specific soil series or soil mapping units where they occur. However, in Merced County, *N. colusana* occurs on clay soils on Merhten and Laguna formations and Riverbank, North Merced gravels. Of the Orcuttieae grasses, *N. colusana* inhabits the widest range of vernal pool sizes, with the smallest being 1,075 ft^2 (100 m^2) and the largest 618 ac (250 ha).

Solano and Yolo County sites where *Neostapfia colusana* grows contain vernal pools formed by soils in the Pescadero series, whereas those in central Merced County are formed by soils in the Landlow and Lewis series. The eastern Merced County and Stanislaus County sites include vernal pool habitats formed by the Bear Creek, Corning, Greenfield, Keyes, Meikle, Pentz, Peters, Raynor, Redding, and Whitney series (Stone *et al.* 1988; EIP Associates 1999; CNDDB 2002). The type and composition of impermeable layers underlying occupied vernal pools also vary, ranging from claypan in the Sacramento Valley to lime-silica cemented hardpan in the San Joaquin Valley basins, to iron-silica cemented hardpan in the eastern margin of the San Joaquin Valley. Tuffaceous alluvium underlies some eastern San Joaquin Valley pools and intermittent streams where *N. colusana* grows (Stone *et al.* 1988).

Further discussion on the life history and habitat characteristics of *Neostapfia colusana* can be found in the final rule to list the species (62 FR 14338).

Tuctoria greenei

George Vasey (1891) originally assigned this species the name *Orcuttia greenei.* Edward Greene had collected the type specimen in 1890 (Vasey 1891), presumably in Butte County (Hoover 1941; Crampton 1959). Citing differences in lemma morphology, arrangement of the spikelets, and other differences, Robert Reeder (1982) segregated the genus *Tuctoria* from *Orcuttia* and created the new scientific name *Tuctoria greenei* (Greene's tuctoria).

Tuctoria greenei is an erect-to-low-growing annual with fragile stems that easily break apart at the nodes, which are often purplish. The leaves are flat and curve outward and the plants are sparsely hairy. The inflorescence is crowded near the tip, with the lower spikelets more or less separated. Optimum germination of *T. greenei* seed occurs when the seed is exposed to light and anaerobic (lacking oxygen) conditions after a cold period of time (stratification) (Keeley 1988). Germination occurs several months after initial inundation (Keeley 1998a). *Tuctoria* seedlings do not develop floating juvenile leaves as does *Orcuttia* (Griggs 1980; Keeley 1998a). *Tuctoria greenei* flowers from May to July (Skinner and Pavlik 1994), with peak flowering in June and July (Griggs 1981; Broyles 1987).

Tuctoria greenei is known from 21 extant widely separated occurrences in Butte, Merced, Shasta, and Tehama Counties. Sixty percent of the extant occurrences of *T. greenei* are in the Vina Plains area of Tehama and Butte Counties. Eastern Merced County has about 30 percent of the known occurrences. Other occurrences are located in Glenn (Oswald and Silveira 1995) and Shasta Counties (CNDDB 2002). *Tuctoria greenei* has been extirpated from Fresno, Madera, San Joaquin, Stanislaus, and Tulare Counties (Stone *et al.* 1988; Skinner and Pavlik 1994; CNDDB 2002).

Tuctoria greenei has been found in three types of vernal pools: Northern Basalt Flow, Northern Claypan, and Northern Hardpan (Stone *et al.* 1988; Sawyer and Keeler-Wolf 1995). Occupied pools are (or were) underlain by iron-silica cemented hardpan, tuffaceous alluvium, or claypan (Stone *et al.* 1988). Of pools where the species was known to be extant in 1987, the median size was 1.5 ac (0.6 ha), with a range of 0.01 ac (50 m^2) to 8.4 ac (3.4 ha) (Stone *et al.* 1988). Stone *et al.* (1988) noted that *T. greenei* grew in shallower pools than other members of the tribe or on the shallow margins of deeper pools, but they did not quantify pool depth. At the Vina Plains, *T. greenei* grew in pools of ''intermediate'' size, which dried in April or early May of 1995 (Alexander and Schlising 1997). The Central Valley pools containing *T. greenei* are (or were) in grasslands; the Shasta County occurrence is surrounded by pine forest (CNDDB 2002). Occupied pools in the Central Valley are (or were) at elevations of 110 to 440 ft (33.5 to 134 m) (Stone *et al.* 1988), whereas the Shasta County occurrence is at 3,500 ft (1,067 m) (CNDDB 2002).

In Tehama and Butte Counties, *Tuctoria greenei* grows mostly on Anita clay and Tuscan loam soils, with one occurrence on Tuscan stony clay loam. Soil types are not certain for several other occurrences in this region; one is on either the Rocklin or the San Joaquin series, and the others are unknown. On the eastern margin of the San Joaquin Valley, *T. greenei* is known to grow on a number of different soil series, including Archerdale, Bear Creek, Exeter, Meikle, Ramona, Raynor, Redding, and San Joaquin.

Further discussion on the life history and habitat characteristics of *Tuctoria*

greenei can be found in the final rule to list the species (62 FR 14338).

Orcuttia pilosa

Robert Hoover (1941) described *Orcuttia pilosa* (hairy Orcutt grass) from specimens he collected in Stanislaus County in 1937. *Orcuttia pilosa* grows in tufts consisting of numerous stems. The stems are decumbent or erect and branch from only the lower nodes. Almost the entire plant is pilose or hairy, giving it a grayish appearance. The spikelets near the tip of the inflorescence are crowded together, whereas those near the base are more widely spaced.

Orcuttia pilosa is known from 28 extant occurrences at widely scattered sites in the southern portion of the Sacramento Valley and the southern Sierra foothills (Keeler-Wolf *et al.* 1998). In the Sacramento Valley, Butte County has one occurrence, Glenn County has six occurrences, and Tehama County has nine occurrences. In the Southern Sierra Foothills Vernal Pool Region, the remaining 12 occurrences of the species are found in widely scattered locations in Stanislaus, Madera, and Merced Counties (Hoover 1941; Crampton 1959; Reeder 1982, Stone *et al.* 1988; CNDDB 2002). Nineteen of those occurrences have been confirmed as existing within the past decade (CNDDB 2002).

This species is found within vernal pools formed on high or low stream terraces and alluvial fans (Stone *et al.* 1988). The median size of occupied pools measured in the late 1980s was 4.2 ac (1.7 ha), with a range of 0.8 to 617.5 ac (0.34 to 250 ha) (Stone *et al.* 1988). At the Vina Plains, *Orcuttia pilosa* was found growing only in pools that held water until May, June, or July in 1995, not in those that dried in April (Alexander and Schlising 1997). This species is known from elevations of 85 ft (26 m) in Glenn County to 405 ft (123 m) in Madera County (CNDDB 2002).

Orcuttia pilosa is found on both acidic and saline-alkaline soils, in pools with an iron-silica cemented hardpan or claypan. In Tehama and Butte Counties, pools supporting *O. pilosa* occur on the Anita and Tuscan soil series (Stone *et al.* 1988; CNDDB 2002). At one pool in the Vina Plains that spans both Anita clay and Tuscan loam soils, *O. pilosa* was found growing primarily on the Anita clay (Alexander and Schlising 1997). At the Sacramento National Wildlife Refuge, *O. pilosa* occurs on the Willows and Riz soil series, whereas in the Southern Sierra Foothills Vernal Pool Region it occurs on the Cometa, Greenfield, Hanford, Meikle, and Whitney soil series (Stone *et al.* 1988).

Further discussion on the life history and habitat characteristics of *Orcuttia pilosa* can be found in the final rule to list the species (62 FR 14338).

Orcuttia viscida

Robert Hoover (1941) first described *Orcuttia viscida* (Sacramento Orcutt grass) as *Orcuttia californica* var. *viscida* based on the type specimen he collected from in Sacramento County. John Reeder (1980) determined that the differences in morphology, seed size, and chromosome number were sufficient grounds to elevate it to the species level as *Orcuttia viscida.*

Orcuttia viscida grass resembles other members of the tribe and genus. Although all members of the Orcuttieae produce a sticky exudate, *O. viscida* is particularly sticky even when young. The plants are densely tufted, bluish green, and covered with hairs. The stems are erect or spreading, 1 to 4 in (3 to 10 cm) long, and do not branch. The inflorescence occupies the upper one-third to one-half of the stem and consists of between 5 and 15 spikelets. The spikelets are closely spaced, and although distichous (arranged in two opposing rows), they are oriented towards one side of the stem.

Orcuttia viscida is endemic to the southeastern Sacramento Valley (Keeler-Wolf *et al.* 1998) and always has been restricted to Sacramento County. From 1990, this species was known from a total of seven natural occurrences and one introduction (Stone *et al.* 1988; CNDDB 2002). Within the past decade, *O. viscida* has been discovered at one new site in Sacramento County within the previously known range. However, one entire occurrence and a portion of another have been extirpated. Thus, eight of the nine occurrences are still in existence. Five occurrences, comprising more than 70 percent of the occupied habitat, are concentrated into a single small area east of Mather Field. Two other occurrences are adjacent to each other: Phoenix Field Ecological Reserve and the introduced occurrence at Phoenix Park. The eighth existing occurrence is near Rancho Seco Lake (Stone *et al.* 1988: Cochrane, in litt. 1995a; CNDDB 2002).

Orcuttia viscida has been found in Northern Hardpan and Northern Volcanic Mudflow vernal pools (Sawyer and Keeler-Wolf 1995). It occurs on high terrace sites (Stone *et al.* 1988) at elevations of 150 to 270 ft (46 to 82 m) (CNDDB 2002). Occupied pools occur in blue oak woodland and annual grassland (Crampton 1959; Griggs 1977; CNDDB 2002). Among occupied pools discovered prior to 1988, the median area was 0.69 ac (0.28 ha) and ranged from 0.25 ac (0.1 ha) to 2.03 ac (0.82 ha). *Orcuttia viscida* grows are acidic with an iron-silica hardpan (Stone *et al.* 1988), and the pools contain numerous cobbles (Crampton 1959; Stone *et al.* 1988). Four of the known occurrences are on soils in the Redding series, two are on Red Bluff-Redding complex soils, two are (or were) on Xerarents-urban land-San Joaquin complex, and one is on Corning complex soils.

Further discussion on the life history and habitat characteristics of *Orcuttia viscida* can be found in the final rule to list the species (62 FR 14338).

Orcuttia inaequalis

Robert Hoover (1936b) described *Orcuttia inaequalis* (San Joaquin Valley Orcutt grass) based on a collection from ''Montpellier [sic], Stanislaus County.'' Robert Hoover (1941) subsequently reduced this taxon to a variety of *californica,* using the combination *Orcuttia californica* var. *inaequalis.* Based on differences in morphology, seed size, and chromosome number, John Reeder (1980) restored the taxon to species status.

Mature plants of *Orcuttia inaequalis* grow in tufts of several erect stems. Plants of this species appear grayish-green due to the long hairs on the stem and leaves and produces exudate. *Orcuttia* plants grow underwater for 3 months or more and have evolved specific adaptations for aquatic growth (Keeley 1998a).

Of the 49 occurrences of *Orcuttia inaequalis* reported in CNDDB (2002), 28 occurrences are presumed extant; 18 are certainly extirpated and three others are possibly extirpated because the habitat has been modified (CNDDB 2002). However, only 12 of the occurrences presumed still in existence have been revisited within the past decade, so even the most recent information is outdated. Of the 28 occurrences of *Orcuttia inaequalis,* Fresno County has two, Madera County has seven, Merced County has 18, and Tulare County has one occurrence. This species has been completely extirpated from Stanislaus County (Stone *et al.* 1988; Skinner and Pavlik 1994; CNDDB 2002).

Orcuttia inaequalis occurs on alluvial fans, high and low stream terraces (Stone *et al.* 1988), and tabletop lava flows (Stebbins *et al.* 1995; CNDDB 2002). This species has been reported in Northern Claypan, Northern Hardpan, and Northern Basalt Flow vernal pools (Sawyer and Keeler-Wolf 1995) within rolling grassland (Crampton 1959). Occupied pools range in surface area from 0.05 to 12.1 ac (0.02 to 4.9 ha), with a median area of 1.54 ac (0.62 ha)

(Stone *et al.* 1988). *Orcuttia inaequalis* has been reported at elevations of 100 to 2,475 ft (30 to 755 m); the highest elevation sites are those on the volcanic tabletops of Fresno and Madera Counties (Stebbins *et al.* 1995; CNDDB 2002).

The pools where *Orcuttia inaequalis* is known to occur form on acidic soils that vary in texture from clay to sandy loam. Soil series represented include the Hideaway series on Fresno-Madera County volcanic tabletops, and Amador, Cometa, Corning, Greenfield, Los Robles, Madera, Peters, Pollasky-Montpellier complex, Raynor, Redding, and San Joaquin soil series elsewhere in the range. The impermeable layer at historical or extant occurrences included iron-silica cemented hardpan, tuffaceous alluvium, and basaltic rock from ancient volcanic flows (Stone *et al.* 1988; Stebbins *et al.* 1995; EIP Associates 1999; CNDDB 2002).

Further discussion on the life history and habitat characteristics of *Orcuttia inaequalis* can be found in the final rule to list the species (62 FR 14338).

Orcuttia tenuis

Albert Hitchcock (1934) named *Orcuttia tenuis* (slender Orcutt grass). The type specimen was collected in Goose Valley, Shasta County, in 1912. *Orcuttia tenuis* grows as single stems or in small tufts consisting of a few stems. Plants are sparsely hairy and branch only from the upper half of the stem. Although its stems typically are erect, they may become decumbent if many branches form near the stem tip (Reeder 1982). The inflorescence comprises more than half of the plant's height, and the spikelets are more or less evenly spaced throughout the inflorescence.

Similar to other vernal pool annuals, the number of individual plants within an occurrence of *Orcuttia tenuis* can vary greatly in size from year to year. Fluctuations of up to four orders of magnitude have been documented in Lake and Shasta Counties (Griggs 1980; Griggs and Jain 1983). At the Vina Plains Preserve, the single occurrence ranged in size from 1,000 to 147,700 individuals during the five times it was reported over a 13-year period (Stone *et al.* 1988; Alexander and Schlising 1997). However, *O. tenuis* occurrences do not always fluctuate in numbers of plants. Among five occurrences of *O. tenuis* that Griggs tracked from 1973 to 1979, two in the Dales area remained at the same order of magnitude for the entire period. None of the other five species of Orcuttieae included in the study remained stable for the full 7 years (Griggs 1980; Griggs and Jain 1983).

Orcuttia tenuis has the largest geographical range of all the members of the Orcuttieae. The species is known from 35 occurrences in Tehama County, 24 in Shasta County, 5 from Lassen County, 4 from Plumas County, 2 in Sacramento County, and 2 each in Butte, Lake, Modoc, Sacramento, and Siskiyou Counties (CNDDB 2002). An additional occurrence has recently been found in Sacramento County (ESA 2001). Extirpated occurrences of *O. tenuis* occur near Reading Airport and Stillwater Plains in Shasta County, and additional possibly extirpated occurrences were near Goose Valley and Battle Creek in Tehama and Shasta Counties (CNDDB 2002).

Orcuttia tenuis is found primarily on substrates of volcanic origin (Crampton 1959; Corbin and Schoolcraft 1989). Vernal pools in which *Orcuttia tenuis* grows are classified as Northern Volcanic Ashflow and Northern Volcanic Mudflow vernal pools (Sawyer and Keeler-Wolf 1995). Impervious layers range from iron-silica hardpan to bedrock (Stone *et al.* 1988; Corbin and Schoolcraft 1989; CNDDB 2001). Among the populations studied by Stone and others (1988), the median area of pools occupied by *O. tenuis* was 1.6 ac (0.65 ha) and ranged from 0.2 to 111 ac (0.08 to 45 ha). On the Modoc Plateau, occupied pools known as of 1989 ranged in size from 5 to 100 ac (2 to 40 ha) and were typically at least 11.8 in (30 cm) deep; this species was restricted to the deepest areas of these pools (Corbin and Schoolcraft 1989). *Orcuttia tenuis* occurs through a wide range of elevations corresponding to its broad geographical range. The lowest reported elevation was 90 ft (27 m) in Sacramento County (Stone et al. 1988) and the highest was 5,761 ft (1,756 m) in Plumas County (Corbin, in litt. 1999).

Soil types supporting vernal pools where *Orcuttia tenuis* is known to occur are diverse, ranging from slightly to strongly acidic (Stone *et al.* 1988), and from clay to sandy, silty, or cobbly loam (Corbin and Schoolcraft 1989; CNDDB 2001). The soil series has not been reported for all *O. tenuis* sites, but the species has been reported on Collayomi-Aiken-Whispering complex and the Konocti-Hambright complex soils. Modoc Plateau occurrences occur on the Gooval, Lasvar, Lasvar-Pitvar complex, and Nosoni soil series, whereas occurrences in northeastern Sacramento Valley are on the Anita, Guenon, Inks, Inskip, Laniger, Moda, Redding, Toomes, and Tuscan soil series. The Redding soil series also supports *O. tenuis* in Sacramento County (Stone *et al.* 1988; CNDDB 2001).

Associated species vary throughout the range of *Orcuttia tenuis.* Although *O. tenuis* grows in the same vernal pool complexes as *O. pillosa* in Tehama County (including the Vina Plains Preserve), and *Orcuttia viscida* in Sacramento County, it has not been found to share any pools with either species (Stone *et al.* 1988; Cochrane *in litt.* 1995a; Alexander and Schlising 1997; CNDDB 2001).

Further discussion on the life history and habitat characteristics of *Orcuttia tenuis* can be found in the final rule to list the species (62 FR 14338).

Tuctoria mucronata

Tuctoria mucronata (Solano grass) was originally described under the name *Orcuttia mucronata* based on specimens collected ''12 miles due south of Dixon, Solano County'' (Crampton 1959, p. 108). John Reeder (1982) transferred this species to a new genus, *Tuctoria,* resulting in the currently accepted name *Tuctoria mucronata.*

Tuctoria mucronata is grayish-green, pilose, and sticky. The tufted stems are decumbent and do not branch. The long leaves are rolled inward and have pointed tips. The base of the inflorescence is partially hidden by the uppermost leaves. As is characteristic of the genus, the spikelets are arranged in a spiral; the spikelets in the inflorescence of *Tuctoria mucronata* are crowded together.

Annual estimates or individual plant counts at Olcott Lake (Holland 1987; CNDDB 2002) indicated that occurrence sizes for this species fluctuate dramatically from year to year, as do other members of the Orcuttieae. *Tuctoria mucronata* was not observed at Olcott Lake from 1976 through 1980, then reappeared in 1981 (Holland 1987), indicating that viable seeds can persist in the soil for a minimum of 5 years. Apparently both drought years and years of excessively high rainfall are unfavorable for *Tuctoria mucronata;* the largest expressions of this species were observed after rainfall seasons of 17.7 to 23.6 in (45 to 60 cm) of precipitation (Holland 1987).

Prior to 1985, *Tuctoria mucronata* was known only from Olcott Lake in Solano County, which is believed to be the type locality (Crampton 1959; CNDDB 2002). A second occurrence was discovered in 1985 approximately 2.5 mi (4 km) southwest of Olcott Lake (CNDDB 2002). *Tuctoria mucronata* is considered to be possibly extirpated from its type locality, because only four individual plants have been found within the last decade, all in 1993 (CNDDB 2002). The other Solano

County site is still in existence. A third occurrence, comprising the largest occurrence known, was discovered in 1993 on a Department of Defense (DOD) communications facility in Yolo County (CNDDB 2002).

Tuctoria mucronata has been found only in the Northern Claypan type of vernal pool (Sawyer and Keeler-Wolf 1995) within annual grassland (CNDDB 2002). Pools where *T. mucronata* occurs tend to be milky from suspended sediments (Holland 1987). The occupied pools in Solano County are more properly described as alkaline playas or intermittent lakes due to their large surface area (Crampton 1959), whereas those at the Yolo County site are ''relatively small'' (Witham, *in litt.* 2000a). Soils underlying known *T. mucronata* sites are saline-alkaline clay or silty clay in the Pescadero series (Crampton 1959; CNDDB 2002). Known occurrences are at elevations of approximately 15 to 35 ft (5 to 11 m) (CNDDB 2002).

Further discussion of the life history and habitat characteristics of *Tuctoria mucronata* can be found in the Delta Green Ground Beetle and Solano Grass Recovery Plan (Service 1985c), and in the final rule to list the species (43 FR 44810; September 28, 1978).

Previous Federal Action

This rulemaking is being made in accordance with a consent decree reached in the U. S. District Court for the Eastern District of California, on December 5, 2002. The following outlines the previous Federal actions and litigation filed after the publication of the proposed rule. For more information regarding Federal actions prior to the publication of the proposed rule, see the Previous Federal Action section in the proposed rule (67 FR 59884).

On September 24, 2002 (67 FR 59884), we published a proposed critical habitat designation for four vernal pool crustaceans and 11 vernal pool plants. Publication of the proposed rule opened a 60-day public comment period, which closed on November 25, 2002. On October 10, 2002, we published a notice (67 FR 63067) announcing three public hearings. The public hearings were held on October 22, 2002, in San Luis Obispo, California; and October 24, 2002, in Sacramento, California, and Medford, Oregon. In addition, public workshops were held in Chico, Sacramento, and Fresno in California and Medford, Oregon. On November 21, 2002, we published a notice announcing the availability of our draft economic analysis (DEA) on the proposed critical habitat designation (67 FR 70201). The notice opened a public comment period on the DEA, and extended the comment period on the proposed critical habitat designation. This comment period was extended for approximately 30 days, closing on December 23, 2002.

On December 5, 2002, the district court approved a settlement agreement between the parties that extended the deadline for designation of critical habitat from February 14, 2003, until July 15, 2003. On March 14, 2003, we published a notice announcing the reopening of the public comment period for approximately 14 days on the proposed designation of critical habitat for these 15 vernal pool species (68 FR 12336) and the DEA, closing on March 28, 2003.

Summary of Comments and Recommendations

In the September 24, 2002, proposed critical habitat designation (67 FR 59884) and subsequent comment periods, we requested all interested parties to submit comments on the specifics of the proposal, including information related to the critical habitat designation, unit boundaries, species occurrence information and distribution, land use designations that may affect critical habitat, potential economic effects of the proposed designation, benefits associated with critical habitat designation, potential exclusions and the associated rationale for the exclusions, and methods used to designate critical habitat.

We contacted all appropriate State and Federal agencies, county governments, elected officials, and other interested parties and invited them to comment. This was accomplished through telephone calls, letters, and news releases faxed and/or mailed to affected elected officials, media outlets, local jurisdictions, interest groups and other interested individuals. In addition, we invited public comment through the publication of legal notices in numerous newspaper and news media throughout California and Oregon. We provided notification of the DEA and proposed rule to all interested parties. At the request of the Merced County Board of Supervisors, we attempted to notify all Merced County landowners within the proposed vernal pool critical habitat and requested that they provide comments. We provided them contacts where they could direct questions regarding the proposed designation. We also posted the proposed rule and DEA and associated material on our Sacramento Fish and Wildlife Office internet site following their release on September 24, 2002, and November 21, 2002, respectively. Additionally, we developed an internet site to provide interactive Geographic Information Systems (GIS) maps of the proposed critical habitat boundaries overlaid on 250K USGS. quadrangle maps.

We received a total of 955 comment letters during the 2 comment periods. Comments were received from Federal, State, and local agencies, and private organizations and individuals. We reviewed all comments received for substantive issues and comments and new information regarding the vernal pool plants and vernal pool crustaceans. Similar comments were grouped into several general issue categories relating specifically to the proposed critical habitat determination and the DEA and are identified below.

Peer Review

We requested 6 biologists, who have knowledge of vernal pool ecosystems and the 15 species addressed in this rule, to provide scientific review of the proposed designation of critical habitat. Three of the six reviewers submitted comments on the proposed designation. Two of the reviewers strongly endorsed the approach in the proposal that protecting vernal pools in the context of surrounding upland watersheds is crucial for the conservation and long-term survival of the listed vernal pool species, and stated that the rule placed appropriate emphasis on protecting intact vernal pool complexes. The reviewers also cited the importance of conserving a wide range of vernal pool habitat types and biological diversity. The reviewers recommended that additional historical locations of the listed species be considered for critical habitat, and specifically recommended inclusion of vernal pool habitat in Santa Barbara County that once supported *Lasthenia conjugens.* The third reviewer provided specific technical comments on the proposed rule and those recommendations have been incorporated into this final rule.

State Agencies

We received comments from the following California State agencies: Department of Fish and Game (CDFG), Department of Forestry and Fire Protection (CDF), Department of Transportation (Caltrans), and the Department of Housing and Community Development (HCD). Technical data provided by the CDFG has been incorporated into or addressed in this final rule, while other issues raised by State agencies are addressed below.

State Comment 1: The CDFG has considerable knowledge of wildlife resources within California, and we

should work with CDFG in developing critical habitat designations for federally listed species.

Our Response: In developing the proposed rule, we solicited information from CDFG biologists familiar with the local land areas through out California, vernal pool species, and vernal pool habitat. We used the local expertise of our counterparts in CDFG regional offices to help us determine which areas were essential to the 15 vernal pool species addressed in this rule, and to determine the appropriate boundaries for the critical habitat. Further, one of the primary data sources that was used in the development of our proposal and this final rule was the State Natural Heritage occurrence and natural diversity database—the CNDDB. We additionally consulted with the CDFG when we had questions regarding species occurrence data and if any new information was available which was not in the database. We view the CDFG as a partner in natural resource management and protection in California, and will continue to work closely with them.

State Comment 2: Some areas within the proposed critical habitat designation do not contain the necessary habitat requirements for the species (*e.g.,* Grasslands Ecological Unit, Merced County).

Our Response: On the basis of information provided by the public, the scientific community, and other Federal, State, and local government officials, we have revised the critical habitat unit boundaries for the 15 vernal pool species, including the area encompassing the Grasslands Ecological Unit, to better reflect those areas containing the primary constituent elements (PCEs) (see Methods, Summary of Changes from Proposed Rule, and Unit Maps).

State Comment 3: The CDFG believes all CDFG lands should be excluded from critical habitat, given the requirement of consultation pursuant to section 7 of the Act for Federal actions, and CDFG's trustee responsibility for protecting the State's wildlife resources, including federally listed species.

Our Response: We have excluded CDFG owned lands within the Battle Creek, Big Sandy, Grizzly Island, Hill Slough, North Grasslands, and Oroville Wildlife Areas and State-owned lands within Allensworth, Boggs Lake, Butte Creek Canyon, Calhoun Cut, Carrizo Plains, Dales Lake, Fagan Marsh, Phoenix Field, San Joaquin River, Stone Corral, and Thomes Creek Ecological Reserves. The total amount of land excluded for State-owned lands excluded within wildlife areas or ecological reserves is approximately 20,933 ac (8,373 ha). These exclusions are based on the CDFG's trustee responsibility for protecting the State's wildlife resources, including federally listed species.

State Comment 4: The CDFG believes that designating critical habitat on lands covered under Habitat Conservation Plans (HCPs) and Natural Community Conservation Plans (NCCPs) provides little benefits for species covered under these plans.

Our Response: We recognize that critical habitat is only one of many conservation tools for federally listed species. However, HCPs are one of the most important tools for reconciling land use with the conservation of listed species on non-Federal lands. Section 4(b)(2) of the Act allows us to exclude from critical habitat designation areas where the benefits of exclusion outweigh the benefits of designation, provided the exclusion will not result in the extinction of the species. We believe that in most instances the benefits of excluding HCPs from critical habitat designations will outweigh the benefits of including them. For this designation, we find that the benefits of exclusion outweigh the benefits of designation for all approved and legally operative HCPs in which vernal pool species are covered. Please refer to the Relationship of Critical Habitat to Habitat Conservation Plans and Relationship of Critical Habitat to the Western Riverside Multiple Species Habitat Conservation Plan sections of this final rule for a more detailed discussion of how approved and pending HCPs have been addressed in this final designation.

State Comment 5: The CDFG believes that all future HCPs and NCCPs should be removed from critical habitat once they are approved.

Our Response: We anticipate that future HCPs in the range of the 15 vernal pool species will include them as a covered species and provide for their long term conservation. We expect that HCPs undertaken by local jurisdictions (*e.g.*, counties and cities) and other parties will identify, protect, and provide appropriate management for those specific lands within the boundaries of the plans that are essential for the long term conservation of the species. Section 10(a)(1)(B) of the Act states that HCPs must meet issuance criteria, including minimizing and mitigating any take of the listed species covered by the permit to the maximum extent practicable, and that the taking must not appreciably reduce the likelihood of the survival and recovery of the species in the wild. We fully expect that our future analyses of HCPs and section 10(a)(1)(B) permits under section 7 will show that covered activities carried out in accordance with the provisions of the HCPs and section 10(a)(1)(B) permits will not result in the destruction or adverse modification of critical habitat designated for the vernal pool species. The take minimization and mitigation measures provided under these HCPs are expected to adequately protect the essential habitat lands designated as critical habitat in this rule, such that the value of these lands for the survival and recovery of the vernal pool species is not appreciably diminished through direct or indirect alterations. If an HCP that addresses the vernal pool species as covered species is ultimately approved, we will reassess the critical habitat boundaries in light of the HCP. If, consistent with available funding and program priorities, we elect to revise this designation, we will do so through a subsequent rulemaking.

The designation of critical habitat should not deter participation in the NCCP or HCP processes. Approvals issued under these processes include assurances of no additional mitigation through the HCP No Surprises regulation (63 FR 8859). The development of new HCPs or NCCPs should not be affected by designation of critical habitat primarily because we view the standards of jeopardy for listed species and of adverse modification for critical habitat as being virtually identical. We discuss these standards in detail in the Section 7 Consultation section portion of this document.

State Comment 6: CDFG expressed concern that designation of critical habitat will increase the regulatory and/or economic burden for project proponents, because many of their programs, such as vegetation management and fire hazard reduction, are administered on private lands with Federal cost-share funds. CDFG also requested us to address land management activities that benefit vernal pool habitats.

Our Response: We do not anticipate that this designation will result in significant increases in regulatory requirements for programs involving Federal cost-share funds over those which have existed since the time of the listing of each of the 15 vernal pool species. All of these activities, to the extent that they modify vernal pool habitat, have the potential to affect federally listed species and thus trigger the informal or formal consultation requirements of section 7 of the Act. Even beneficial land management actions, if they are likely to result in ''take'' of listed vernal pool crustaceans, must receive appropriate incidental take

authorization through section 7 or section 10 of the Act. The regulatory requirements of section 7 consultation that are established with the listing of a species and the requirements associated with critical habitat designation are discussed in detail in the section Effects of Critical Habitat Designation. A discussion of land management activities, including prescribed burning and grazing, that are beneficial to vernal pool habitats, can be found in the section Special Management Considerations.

State Comment 7: Caltrans requested that we exclude transportation infrastructure, particularly operating right-of-way, from the designation because these areas are not essential to the conservation of the species.

Our Response: We understand the concern of the transportation agencies over having habitat within transportation infrastructure designated as critical habitat. Such areas are included in this designation for several reasons: (1) many areas contain occurrences of the listed vernal pool species and the PCEs; and (2) we did not have the time, resources, or the appropriate GIS data layers to segregate these areas from adjacent vernal pool habitat, evaluate their importance to the conservation of the 15 vernal pool species separately from adjacent vernal pool habitat that we had determined to be essential, and then produce maps and legal descriptions of essential habitat around them, but not including them. Many transportation agency activities involving right-of-way maintenance already trigger section 7 consultation requirements because they support habitat occupied by listed vernal pool species, and because of the Federal nexus provided by the Federal Highway Administration. We do not anticipate that this designation will result in a significant increase in regulatory requirements over those that have existed since the time of the listing of each of the 15 vernal pool species. A more detailed explanation of regulatory requirements of section 7 consultation that are established with the listing of a species, and the requirements associated with critical habitat designation, are discussed in the section Effects of Critical Habitat Designation.

State Comment 8: The HCD commented that the information and public review period for the draft economic analysis was insufficient, expressed concern over the broad standardized scale of the economic analysis, and suggested that a more discrete level of analysis is necessary to credibly project economic costs and benefits of the designation through the 20-year analysis period.

Our Response: The draft economic analysis of the proposed critical habitat designation was made available to the public for review and comment on November 21, 2002, (67 FR 70201). At that time, we opened a 30-day public comment period, on both the proposal and the draft economic analysis, which closed on December 23, 2003. On March 14, 2003, we reopened the comment period for both the proposal and the draft economic analysis for an additional 14 days, ending March 28, 2003 (68 FR 12336). Consequently, the public was provided approximately 45-days to review and provide comment on the draft economic analysis. As stated in this final rule, we acknowledge the limitations imposed by conducting public rulemaking under abbreviated, court mandated schedules, and that, as a result, we are not always able to provide adequate public participation in the process.

For large designations, such as this rule, the 4(b)(2) decision will consider broad geographic areas, rather than individual parcels or projects. The level of detail provided in this analysis is appropriate to the size of areas considered for exclusion. In addition, a more detailed analysis would not necessarily produce a more accurate estimate of potential impacts. Parcel-by-parcel analysis of costs may achieve greater certainty for projects that have already been approved by local planners. However predicting the location and characteristics of future projects on a parcel-by-parcel basis using the same sources of data will result in greater uncertainty as the time frame for the analysis increases. For this rulemaking, it is unlikely that a more detailed analysis would produce a significantly different answer.

Other Public Comments and Responses

We address other substantive comments and accompanying information in the following summary. Relatively minor editing changes and reference updates suggested by commenters have been incorporated into this final rule or the final economic analysis, as appropriate.

Issue 1—Habitat and Species Specific Information

Comment 1: Several commenters, including county and local governmental representatives, stated that the designation was not based on the best scientific data available, and that we have not adequately established that the areas identified as critical habitat contain PCEs essential for the species.

Our Response: We believe that we used the best scientific and commercial information available in determined those areas essential for the 15 vernal pool species that were proposed as critical habitat and subsequently finalized. However, the mapping scale that we used resulted in a more inclusive proposal. In our final determination, we had additional information available to us, including detailed aerial imagery and other information provided by commenters to assist us in refining our mapping of essential habitat. Please refer to the Background, Criteria Used to Identify Critical Habitat, and Unit Description sections of this rule for further discussion on how we determined habitat that is essential to the conservation of the 15 vernal pool species. After refining our proposal and weighing the best available information, we conclude that the areas designated by this final rule, including currently occupied and unoccupied areas, are essential for the conservation of these species.

Comment 2: Several commenters held that nothing has changed from the listing of the species, and that our determination that the designation of critical habitat was not prudent or determinable should remain in place. One commenter stated that we did not evaluate whether critical habitat was determinable and that an analysis needs to be performed according to regulations.

Our Response: As outlined in the Prudency Redetermination section of the proposed rule, at the time of the final listing determination for the 15 vernal pool species, we found that designation of critical habitat was not prudent for the vernal pool crustaceans and plants (excluding *Tuctoria mucronata*) because of potential threats, and that a designation of critical habitat was not beneficial for these species. Case law (*Conservation Council For Hawai'i* v. *Babbitt,* 2 F. Supp.2d 1280 (D.Hawai'i 1998) and *Natural Resources Defense Council* v. *U.S. Dept. of Interior,* 113 F.3d 1121 (9th Cir. 1997)) has changed how we balance the risks and benefits of critical habitat designations since we listed the 15 vernal pool species. In *Building Industry Association* v. *Babbitt,* 979 F Supp. 893 (1997), we were directed by the court to reevaluate our not prudent determination for the four listed vernal pool crustaceans. Our record lead us to reconsider our previous not prudent determinations for the 11 plants in light of the new case law and policy. We have

determined that the threats to the vernal pool crustaceans and plants and their habitat from the specific instances of habitat destruction we identified in the final listing rules do not outweigh the broader educational, regulatory, and other possible benefits that a designation of critical habitat would provide for these species. We believe there is sufficient information available on the 15 vernal pool species to find that critical habitat is determinable for these species, and that an analysis of the impacts of the designation can be performed according to 50 CFR 424.12(a)(2)(i).

Comment 3: Several commenters stated that the species are not threatened or endangered because of their widespread distribution.

Our Response: Species may be listed under the Act if the species is in danger of extinction throughout all or a significant portion of its range by one or more of the five listing factors (endangered species), or if the species is likely to become endangered in the foreseeable future, throughout all or a significant portion of its range by one or more of the five listing factors (threatened species). The five listing factors as defined in the Act are: (A) The present or threatened destruction, modification, or curtailment of [a species'] habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural and manmade factors affecting [a species'] continued existence. These factors apply to both narrowly and widely distributed species.

As discussed in the final rules to list the 15 vernal species addressed herein, the vernal pool crustaceans and plants are threatened by habitat loss, degradation, and modification from land conversion and degradation to the extent that known populations are endangered, or likely to become endangered, throughout all or a significant portion of their range. Thus, the vernal pool species are threatened by Factor A and appear to meet the definitions of threatened or endangered, regardless of having a relatively extensive distribution.

Comment 4: Several commenters believe that we cannot realistically determine critical habitat without first developing a recovery plan, and that the determination of critical habitat should be postponed until site specific surveys have been conducted and a recovery plan is in place.

Our Response: Section 4 of the Act requires us to designate critical habitat at the time of listing to the maximum extent prudent and determinable. We concur that a recovery plan is a useful tool in assisting us with determining which areas are essential for the conservation of a species. We are currently developing a draft recovery plan for these vernal pool species, and have been able to use the information and gathered and analysis conducted to date for the draft recovery plan in helping us determine areas essential to the conservation of the 15 vernal pool species addressed herein.

Comment 5: Several commenters reported that vernal pools provide a breeding source for mosquitoes. They stated that the designation would lead to an increase in diseases such as infection of the West Nile virus (*Flavivirus* sp.) and other mosquito-vectored diseases.

Our Response: The best information available to us indicates that non-degraded vernal pools and swales do not provide a significant breeding source for mosquitoes. Mosquitoes do not appear in vernal pools until very late in the season, when they are unlikely to complete their development before the pools dry (Wright 1991). Female mosquitoes are attracted to gases produced by fermentation that indicate an abundance of decaying organic matter suitable for food for mosquito larvae (Wright 1991). This is the likely cue used by females mosquitos to select oviposition sites. Healthy vernal pools appear to have relatively low levels of decaying organic material, which makes them undesirable as oviposition sites for gravid mosquitoes (Wright 1991). Only late in the season, when the abundance of invertebrates in vernal pools begins to decline, are enough nutrients and organic material available to make the vernal pools attractive to mosquitos. By this time, however, it is often too late for the mosquito larvae to develop before the pools dry.

Comment 6: One commenter stated that there are occurrences of the vernal pool plants and vernal pool crustaceans on protected lands, and for this reason, additional lands are not needed for the conservation of the species. Other commenters contended that the acreage in the proposed rule should represent the minimum amount of land considered critical for the 15 vernal pool species.

Our Response: We recognize that while some occurrences of the vernal pool plants and vernal pool crustaceans are found on protected public and private lands, only about 16 percent of the lands designated as critical habitat are on Federal land or are protected by a conservation easement. A smaller percentage of these lands are managed for protection of vernal pool resources and specifically for the species addressed in this rule. Restricting the designation to currently protected lands would exclude areas that we believe are essential to the conservation of the 15 vernal pool species. We based the designation on the best scientific available and determined that the designation identifies those areas believed to be essential for the conservation of the species.

Comment 7: The California Army National Guard (ARNG) asks that Camp Roberts be excluded from the final critical habitat designation (ARNG 2002a). Letters from Fort Hunter Liggett and the Headquarters of the United States Army Reserve Command state they do not agree with designating critical habitat on the base, and that the designation is not necessary to protect vernal pool fairy shrimp (Fort Hunter Liggett 2002b; Department of the Army 2002).

The letters from Camp Roberts and Fort Hunter Liggett present numerous reasons why critical habitat designation is not warranted on the two bases. Some of these reasons include: suggestions that each installation has an Integrated Natural Resources Management Plan (INRMP) that provides protective measures for vernal pool fairy shrimp; the two bases are implementing numerous activities that conserve vernal pool fairy shrimp habitat; and critical habitat designation would adversely affect the National Guard and Army's abilities to meet their mission, *i.e.*, train soldiers for combat situations.

Our Response: Camp Roberts and Fort Hunter Liggett have drafted INRMPs that we have not signed. The current documents are therefore working drafts that are being revised as the National Guard and Army work together with us to finalize conservation strategies that will benefit all listed species on the two bases. After adequate conservation strategies for all listed species on the bases are incorporated into the two INRMPs, we expect to sign the documents and will consider them final. We recognize the military is implementing measures to conserve existing locations of vernal pool fairy shrimp and the habitat they occupy. These activities include periodic monitoring of selected pools, control of exotic plant species that may alter vegetation communities around vernal pool habitat, fencing or delineation of areas known to contain vernal pool fairy shrimp, and use of review processes designed to avoid or minimize effects that may arise during military training activities and base operations. We

believe additional measures are needed to promote natural ecosystem processes that benefit listed fairy shrimp and these items will continue to be the focus of future discussions with the military. We recognize that designation of critical habitat has the potential to modify military training operations and the use or development of base facilities. We have determined that the benefits of excluding these facilities outweigh the benefits of including them. Subsequently, Camp Roberts and Fort Hunter Liggett have been excluded from this final designation of critical habitat.

Comment 8: One commenter requests that the Indian Valley Cattle Company and Porter Ranch Estate properties be excluded from the Bradley-San Miguel critical habitat subunit in Monterey County. The commenter references a letter from a consulting firm which states that habitat mapping on one or both of the above-mentioned properties was done, and that suitable habitat for fairy shrimp does not appear to be present. The consultant's letter states that another company conducted fairy shrimp surveys on the Porter Ranch Estate, and these investigators did not find fairy shrimp.

Our Response: The Service's ''Interim Survey Guidelines to Permittees under Section 10(a)(1)(A) of the Endangered Species Act for the Listed Vernal Pool Branchiopods'' is used to establish the presence or absence of listed fairy shrimp on a particular property. The guidelines recommend that two wet season surveys for adult fairy shrimp, or one wet season survey for adult and one dry season survey for fairy shrimp cysts, be done at a site to determine the presence or absence of fairy shrimp. Both surveys should demonstrate that fairy shrimp are absent before the Service will concur with a determination that fairy shrimp are absent from a site. We received a report from a consultant in 2001 that states ephemeral aquatic habitat may occur on the Porter Ranch Estate. We also received documents that indicate two wet season surveys were conducted on that property. The second wet season survey was done during a year when rainfall conditions were not conducive to detecting adult fairy shrimp, *i.e.*, aquatic habitat was not present during the second survey, and it would not therefore have been possible to determine the presence or absence of fairy shrimp. We do not have appropriate documentation at this time that allows us to conclude that fairy shrimp are absent from the Porter Ranch Estate.

While we do not have specific information that demonstrates that fairy shrimp occur on the Indian Valley Cattle Company and Porter Ranch Estate properties, we know vernal pool fairy shrimp occur on the Camp Roberts military base 1 mi (1.6 km) west of Porter Ranch Estate and 0.5 mi (0.8 km) south of the Indian Valley Cattle Company property. We believe additional undocumented occurrences of listed fairy shrimp are likely to occur in suitable habitat on private property near Camp Roberts. We also believe several unmapped vernal pools are likely to occur on or near the two aforementioned properties because the presence of several hundred vernal pools on Camp Roberts suggests that these features are present within the local landscape. The Indian Valley Cattle Company and Porter Ranch Estate properties are up gradient and in close proximity to known and suspected vernal pool fairy shrimp occurrences, and it is likely that water that originates on these properties travels down gradient and contributes to the maintenance of the hydrology and water quality of vernal pools that are occupied by listed fairy shrimp on or near the Camp Roberts military base.

Following our evaluation of these lands, we still believe the Indian Valley Cattle Company and Porter Ranch Estate properties are within the localized watershed that contains essential vernal pool habitat, and they contribute to the maintenance of their hydrology. Consequently, it is our determination the land on these properties is essential to the conservation of vernal pool habitat and should not be excluded from designated critical habitat.

Comment 9: One individual asks that the Estrella Ranch area in San Luis Obispo County be removed from the Paso Robles critical habitat subunit. The landowner does not believe fairy shrimp or vernal pool habitat exist on that ranch, and they are concerned that critical habitat designation will affect their family's ranching activities.

Our Response: The Estrella Ranch occurs within a localized watershed that contains documented occurrences of listed fairy shrimp. Vernal pools complexes measuring at least 10 ac (4 ha) in size have been mapped within 1–2 mi (1.6–3.2 km) of Estrella Ranch. These complexes were identified during a habitat mapping contract (Holland 2003). The mapping contract did not attempt to map wetlands less than 10 ac (4 ha) in size, and it is likely that smaller, unmapped vernal pools or vernal pool complexes which provide the necessary conditions for vernal pool fairy shrimp to hatch, grow, and reproduce are present in the local area.

Estrella Ranch is up gradient of vernal pool complexes that have been mapped, and the topography of the ranch suggests water that originates on that property is likely to travel down gradient and contribute to the amount, duration, and frequency of water flow necessary to maintain vernal pools southwest of the ranch property boundary.

We believe Estrella Ranch occurs within a localized watershed that contains essential vernal pool habitat, and the ranch contributes to the maintenance of their hydrology. Consequently, it is our determination this property is essential to the conservation of documented vernal pool habitats, and should not be excluded from designated critical habitat.

Critical habitat designation will not affect the private landowner unless specific portions of their property possess the primary constituent elements associated with vernal pool fasiry shrimp critical habitat, and the landowner proposes a project that would involve a Federal nexus. The landowner has told Service employees he has historically avoided projects that would create a Federal nexus. Consequently, we do not believe the designation of critical habitat on Estrella Ranch will significantly affect the landowner's ranching activities.

Comment 10: One individual associated with the Coastal Alliance on Planned Expansion asks that we evaluate the possibility that fairy shrimp are adversely affected by the operation of a power plant near the Morro Bay National Estuary in San Luis Obispo County. The commentor is concerned that use of ocean water to cool various hardware components at the power plant may affect fairy shrimp.

Our Response: Fairy shrimp are inland species and are not associated with marine environments. The intake of water to cool the power plant near Morro Bay does not have the potential to adversely affect vernal pool fairy shrimp or their habitat.

Comment 11: A number of commenters expressed concern over the appropriateness of the proposal of Unit 33A for vernal pool fairy shrimp. Riverside County Flood Control and Water Conservation District stated that the Unit boundary is based on their ''approximate riverine flood plain'' boundary and suggested that a more detailed analysis of local hydrologic sources and watersheds associated with vernal pools would be more accurate. Other concerns raised were: (1) The vernal pool fairy shrimp is not associated with riverine systems; (2) the Unit contains areas which do not

contain vernal pools and do not meet the proposed rule's definition of critical habitat; (3) vernal pool fairy shrimp have not been documented in the San Jacinto Unit (33A); and (4) vernal pool fairy shrimp and the common versatile shrimp (*Branchinecta lindahli*) cannot co-occur.

Our Response: Although the boundary of the Unit 33A is the approximate 20-year floodplain as identified by Riverside County Flood Control and Water Conservation District, it was used because more than 99 percent of the known vernal pool associated species in the floodplain occur within area delineated by that boundary. The reach of the San Jacinto River included in the designation is extremely flat, causing the river to pond on the floodplain from the low-flow channel to the approximate 100-year floodplain. In the rainy season, the river floodplain contains vernal pools, moist flats, and other ephemeral wetlands. Areas which do not expressly contain ephemeral wetlands or vernal pools are included to provide hydrology to vernal pools.

Although surveys conducted in this unit during 2000 failed to detect vernal pool fairy shrimp, although the common versatile fairy shrimp was detected, it is important to note that not all of the pools in the floodplain were surveyed, and rainfall conditions were not conducive to detecting fairy shrimp. (*i.e.,* in some places pools did not fill or filled only briefly'an insufficient time for shrimp, if present, to hatch).

This unit can be characterized as an alkali playa, one of the habitat types that supports vernal pool fairy shrimp, and shares soil and hydrologic characteristics with Unit 33B, where the common versatile and vernal pool fairy shrimp co-occur. Both species are also present at Skunk Hollow. Eriksen and Belk (1999) also report that the common versatile fairy shrimp is known to co-occur with the vernal pool fairy shrimp, although the two species may be detectable at varying times during a vernal pool's wet phase.

This unit is essential to vernal pool fairy shrimp because it represents the largest unfragmented, hydrologically and ecologically functional vernal pool complex in the southern portion of the species' range. The area of habitat is large enough to allow localized occurrences to expand and contract, providing for normal population dynamics and making the populations within this unit less susceptible to environmental variation or negative impacts associated with human disturbances or naturally occurring catastrophic events. Although it is not known to be occupied, it contains the same edaphic and land form characteristics as lands within Unit 33B, which is occupied by the species.

Comment 12: One commenter stated that the Riverside County units (33–35) should be removed from designation because they represent only a small portion of the range of the vernal pool fairy shrimp, and these areas are already being protected.

Our Response: The area proposed as critical habitat for the vernal pool fairy shrimp in Riverside County does comprise a small portion of the overall area proposed as critical habitat for the species. However, the vernal pools in these units supporting populations of the vernal pool fairy shrimp represent the southernmost distribution of the species in the Unites States. They are essential to ensuring the genetic and geographic distribution of the species necessary for its long-term conservation.

We are excluding the critical habitat in Riverside County, California (Units 33, 34 and 35) from this final designation. We are excluding Unit 33 for the vernal pool fairy shrimp from final designation because the vernal pool habitat within this unit will be covered by the draft Western Riverside Multiple Species Habitat Conservation Plan (MSHCP). Although the MSHCP has not been finalized the measures afforded within the plan and the current assurances that the plan will be completed will assist in the conservation of the species. We are also excluding Unit 34 for the vernal pool fairy shrimp from final designation because the vernal pool within this unit is covered by an approved, legally operative HCP. Although the Rancho Bella Vista HCP does not include the vernal pool fairy shrimp as a covered species, the endangered Riverside fairy shrimp is covered by this HCP. Because the Riverside fairy shrimp co-occurs with the vernal pool fairy shrimp in this unit, we anticipate that management actions taken to conserve Riverside fairy shrimp will provide equal benefits to the vernal pool fairy shrimp. We have also excluded Unit 35 for vernal pool fairy shrimp from final designation because this area, which lies within the Santa Rosa Plateau Ecological Reserve, is managed for the conservation of vernal pools that support populations of the vernal pool fairy shrimp. Please refer to the Relationship of Critical Habitat to Habitat Conservation Plans, Relationship of Critical Habitat to the Western Riverside Multiple Species Habitat Conservation Plan, and Relationship of Critical Habitat to Santa Rosa Plateau Ecological Reserve: A State, Federal, and Local Cooperatively Managed Reserve sections of this final rule for a more detailed discussion of these exclusions.

Comment 13: Riverside County Flood Control and Water Conservation District stated that they are working with the City of Hemet to model the watershed in Unit 33B. They suggested that the designation be reduced or eliminated until the information is available.

Our Response: We have excluding Unit 33 from this final designation of critical habitat for the 15 vernal pool species on the basis of the development of the Western Riverside Multi-Species Habitat Conservation Plan (see Response to Comment 12 above).

Issue 2—Costs and Regulatory Burden

Comment 14: Regarding the Fort Ord Unit of critical habitat for *Lasthenia conjugens,* the Bureau of Land Management (BLM) provides comments about inclusion of two parcels, totaling less than 40 ac (16.2 ha), that are (or will be) transferred to the BLM and are designated for development under the Army's existing base cleanup, disposal, and reuse plan. The BLM expresses concern that inclusion of these parcels may require numerous consultations with us for small BLM development projects, such as the construction of a storage shed, that would have minor or negligible impacts on the species and its critical habitat. This would add an undue regulatory burden on BLM and the Service.

Our Response: All Federal agencies are required to evaluate whether projects they authorize, fund, or carry out, may adversely affect a federally listed species and/or its designated critical habitat. The parcels under discussion do not possess ephemeral wetlands themselves, but activities on them may affect the watershed of ephemeral wetlands located on adjacent parcels. To improve the efficiency of the consultation process, we recommend BLM staff with hydrologic expertise evaluate the potential for BLM activities to affect the hydrology of ephemeral wetlands in critical habitat. If BLM projects are not likely to adversely affect critical habitat, then a consultation with us would not be necessary. For projects that are likely to have only discountable, insignificant, or wholly beneficial effects on critical habitat, we would concur in writing and no further consultation will be necessary. For projects likely to have adverse affects on critical habitat, formal consultation would be required pursuant to section 7 of the Act. We encourage BLM to pursue a programmatic evaluation of, and consultation on, its current and future activities on former Fort Ord lands. In regard to these specific parcels, we have

adjusted the boundaries of Unit 9 to remove the steep terrain in and around Impossible and Wildcat Canyons, for reasons discussed in the Summary of Changes From the Proposed Rule section. This has resulted in the removal of one of the above-mentioned parcels from this critical habitat designation. A 13 ac (5.3 ha) BLM development parcel remains in critical habitat.

Comment 15: The Army requests that we exclude areas from *Lasthenia conjugens* critical habitat within former Fort Ord (Unit 9) that are designated for future development under the Army's Habitat Management Plan (HMP). They state that their HMP, which describes the conservation strategy for cleanup, disposal, and reuse of the former base, meets the three criteria we use to consider whether a plan provides adequate special management or protection. The Army suggests these areas be excluded pursuant to section 3(5)(A) of the Act, because they do not require additional special management or protection under the HMP. The Army also requests that we exclude these areas, pursuant to section 4(b)(2) of the Act, because the benefits of excluding them outweigh the benefits of including them in critical habitat. The specific parcels they request be excluded are the BLM development parcel, the Military Operations-Urban Terrain Facility, Wolf Hill, and those portions of East Garrison identified for future development, a total of fewer than 200 ac (90 ha).

Our Response: The 28,000 (11,331 ha) former Army base at Fort Ord is managed under an HMP that, along with several additional commitments from the Army, provided the basis for a non-jeopardy biological opinion in 1999 on the effects of base closure and reuse on *Lasthenia conjugens.* This biological opinion encompassed the full base and, therefore, the entire critical habitat unit. We determined at that time that the configuration of habitat reserve and development lands in the HMP will not jeopardize the continued existence of *Lasthenia conjugens.* The HMP requires that management of designated development parcels that border habitat reserve lands incorporate measures to avoid erosion and vehicle access that could degrade habitat reserve lands, including those designated as critical habitat for *Lasthenia conjugens.* However we conclude that, at this time, the conservation strategy outlined in the HMP for base reuse and closure does not provide sufficient management and protections to the extent that these lands do not meet the definition of critical habitat. Completion of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process in which the Army is currently engaged, and completion of an HCP by entities that are to receive transferred lands, followed by our issuance of an incidental take permit for these lands, would likely be considered adequate special management such that these lands could be removed from critical habitat.

We have reviewed the circumstances at former Fort Ord and conclude that exclusions under sections 3(5)(A) and 4(b)(2) of the Act are not appropriate for lands in this unit. In past circumstances, we have either not included or excluded lands from critical habitat, pursuant to section 3(5)(A) of the Act, when we have determined that the lands are either not essential to the conservation of the species, or have adequate special management considerations or protections. If an area has adequate management or protections for the species and its habitat then the area does not meet the definition of critical habitat and consequently either not included or excluded if originally proposed. At former Fort Ord, the lands for which exclusions were requested are designated for development under the base closure and reuse plan and the management of these lands for vernal pool habitat and species is not adequately addressed under the HMP. The lands are also not intended to receive further protection under that plan. Therefore, a definitional exclusion from critical habitat pursuant to section 3(5)(A) of the Act, where lands would not require special management considerations or protections because those provisions are already in place, would not be warranted for these lands.

We also evaluated these parcels for exclusion from critical habitat pursuant to section 4(b)(2) of the Act. Section 4(b)(2) of the Act allows the Secretary to ''exclude any area from critical habitat if [it is determined] that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, * * * unless the failure to designate such area * * * would result in the extinction of the species.'' In evaluating whether the benefits of excluding these lands outweigh the benefits of including them, we considered economic impact and any other relevant impact associated with their inclusion. In the case of former Fort Ord, we evaluated whether an increase in Federal consultations was likely to occur due to the inclusion of these lands, resulting in an economic cost. We concluded that Federal consultation requirements would be essentially unchanged by the inclusion of theselands. Therefore, none of the costs associated with increased consultation requirements base-wide are likely to result from inclusion of these lands. The Army did not indicate any other costs associated with inclusion of these lands, nor could we identify any. Therefore, we concluded there are no benefits of excluding these lands from critical habitat. We weighed this against any benefits that might accrue from inclusion of these lands in critical habitat. We determined that a small benefit of inclusion would be the increased attention the designation would bring to those parcels designated for development that are adjacent to, and likely within the watershed of, vernal pools. The inclusion of these lands in critical habitat would remind land managers of the need to consider the presence of the vernal pool watershed in planning and implementing Federal actions. We weighed this benefit of inclusion against the benefits of exclusion. We conclude that the benefits of exclusion do not outweigh the benefits of inclusion. We have, therefore, included these lands in the critical habitat designation, except as discussed below.

We have adjusted the boundaries of the Fort Ord Unit to remove the steep terrain in and around Impossible and Wildcat Canyons, for reasons discussed in the Summary of Changes From the Proposed Rule section. The Military Operations-Urban Terrain Facility and Wolf Hill parcels (totaling about 110 ac (44.5 ha) discussed above are located in this region and are therefore not part of designated critical habitat.

Comment 16: The U.S. Air Force requests that lands at Beale Air Force Base (AFB) and Travis AFB be excluded because the designation would increase the costs and regulatory requirements and hamper the Air Force on carrying out the mission objectives for the two AFBs.

Our Response: In response to the U.S. Air Force's requests that lands at Beale AFB and Travis AFB be excluded because the designation would increase the costs and regulatory requirements and hamper the Air Force's ability to carry out their mission objectives for the two AFBs, we have excluded these AFB installations from final designated critical habitat pursuant to section 4(b)(2) of the Act. Please refer to the Relationship of Critical Habitat to Military Lands section of this final rule for a detailed discussion of our rationale for excluding these AFBs pursuant to section 4(b)(2) of the Act.

Comment 17: Several commenters expressed concern that the designation would curtail or eliminate livestock grazing in areas containing vernal pools.

Our Response: Only those activities which are federally funded or authorized that may affect critical habitat would be subject to the regulations pertaining to critical habitat. We recognize and acknowledge that certain levels of livestock grazing likely have no impact on vernal pool ecosystems, and may be beneficial for maintaining them. Since the vast majority of vernal pool habitat within the designation is occupied by the listed vernal pool species and occurs on privately owned lands, the designation of critical habitat is not likely to result in a significant increase in regulatory requirements above those already in place due to the presence of the listed species.

Vernal pools and the species within this rule evolved with the presence of large ungulate grazing. Grazing deters the encroachment of grass and other upland species into the vernal pools, and reduces the vegetative cover of upland areas potentially allowing space for soil dwelling pollinator species to exist. However, the amount and timing of grazing can greatly influence species abundance and composition within each vernal pool.

Comment 18: California Army National Guard-Camp Roberts and Fort Hunter Liggett provide analyses that describe anticipated economic impacts that would arise on the military bases and in surrounding communities if critical habitat is designated for vernal pool fairy shrimp on their property. Camp Roberts estimates the impacts from critical habitat to be approximately $95.4 million (ARNG 2002b). The majority of these costs would accrue because the military believes a critical habitat designation would create a need to relocate training activities to other military bases where critical habitat is not designated. They also believe 31 projects may need to be canceled or substantially modified during the next 20 years. The letter from Camp Roberts also states that local communities around the base would also be affected by critical habitat designation, and the potential effects to these communities are estimated to be $50.5 million.

Staff at Fort Hunter Liggett believe the cost of designating critical habitat on their base would be approximately $7.35 million over a 10-year period (FHL 2002b). The Army believes a $5 million cost would be incurred because of changes to a prescribed fire program. Additional costs may be incurred because Fort Hunter Liggett staff estimate they will need to complete 36 informal and 16 formal consultations during the next 20 years as a result of the critical habitat designation. The letter also states that the Army believes our cost estimates associated with the critical habitat designation, as described in the economic analysis, are too low.

Our Response: California Army National Guard-Camp Roberts and Fort Hunter Liggett provide analyses that describe anticipated economic impacts that would arise on the military bases and in surrounding communities if critical habitat is designated for vernal pool fairy shrimp on their property. Camp Roberts estimates the impacts from critical habitat to be approximately $95.4 million (ARNG 2002b). The majority of these costs would accrue because the military believes a critical habitat designation would create a need to relocate training activities to other military bases where critical habitat is not designated. They also believe 31 projects may need to be canceled or substantially modified during the next 20 years. The letter from Camp Roberts also states that local communities around the base would also be affected by critical habitat designation, and the potential effects to these communities are estimated to be $50.5 million.

Staff at Fort Hunter Liggett believe the cost of designating critical habitat on their base would be approximately $7.35 million over a 10-year period (FHL 2002b). The Army believes a $5 million cost would be incurred because of changes to a prescribed fire program. Additional costs may be incurred because Fort Hunter Liggett staff estimate they will need to complete 36 informal and 16 formal consultations during the next 20 years as a result of the critical habitat designation. The letter also states that the Army believes our cost estimates associated with the critical habitat designation, as described in the economic analysis, are too low.

Comment 19: A planner from the City of El Paso Robles asks that we describe what effect critical habitat designation has on new development projects. The letter suggests critical habitat designation results in the need to set aside vernal pools as ecological preserves. A facsimile transmittal from a small farming company also asks that we describe how critical habitat designation could affect their farming operations.

Our Response: The designation of critical habitat requires that Federal agencies consult with us on actions they carry out, fund, or authorize that might destroy or adversely modify the critical habitat. A critical habitat designation has no effect on actions where a Federal agency is not involved (Federal nexus). For example, a landowner undertaking a lawful project on private land that involves no Federal funding or Federal permits would not be affected by the critical habitat designation. If a Federal nexus did develop on private land that was included in a critical habitat unit, *e.g.*, a private landowner needed a permit from the U.S. Army Corps of Engineers (Corps) for fill to be placed in a wetland, the project would need to undergo a review process with the Service.

Under the Act, a critical habitat designation establishes a geographic area that is essential for the conservation of threatened or endangered species and may require special management considerations or protections. However, a designation does not affect the land ownership or establish a refuge, wilderness, reserve, preserve, or other special conservation area. It does not allow government or public access to private land, and will not result in the closure of the area to all access or use. Rather, it triggers the requirement that Federal agencies must consult with us on activities they fund or carry out that might affect critical habitat. Please refer to the Effects of Critical Habitat section below for further explanation of effects of critical habitat designation and its effects on development and farming operations.

Issue 3—Notification and Public Comment

Comment 20: A number of commenters stated that landowners were either not notified, or not notified in a timely manner, and given an adequate opportunity to comment on the proposed designation. The commenters also stated that the number of public hearings was inadequate to obtain full public input on the proposal and that additional public hearings should be held. Several commenters stated that the 30-day comment period for the DEA violated 50 CFR 424.16(c)(2) and requested that we extend the comment period on the proposed designation and draft economic analysis to allow for additional outreach to interested parties as well as hold more public hearings.

Our Response: We are obligated to hold at least one public hearing on a listing proposal if requested to do so prior to 15 days before the end of a comment period (16 U.S.C. 1533(b)(5)(E)). We held a total of 6 public hearing on our proposal to designate critical habitat for the 15 vernal pool species: two public hearings on October 22, 2002, in San Luis Obispo, California; two in Medford, Oregon, on October 24, 2002; and two on October 24, 2002, in Sacramento, California. We also organized three public workshops to notify the public of

the proposed designation and to answer questions regarding critical habitat and the proposed rule: October 3, 2002, in Chico, California; October 16, 2002, in Fresno, California; and October 17, 2002, Sacramento, California. In addition to the public hearings and public workshops, we attended a public meeting organized by the Merced County Council in Merced, California on November 12, 2002, to discuss the proposed designation of critical habitat and answer questions regarding the area designated within Merced County. We provided information on where to obtain copies of the proposed rule and how to access the critical habitat website showing maps of the designation.

Written public comments were accepted at all the public hearings, workshops, and the Merced County Council meeting and entered into the supporting record for the rulemaking. Oral comments given at the public hearings were also accepted into the supporting record. In making our decision on the critical habitat designation, written comments were given the same weight as oral comments presented at hearings. We conducted much of our outreach through legal notices in numerous regional newspapers, telephone calls, letters, and news releases faxed and/or mailed to affected officials, local jurisdictions, and interest groups. We also posted the proposed determination, schedule of workshops and hearings, and other associated material on our Sacramento Fish and Wildlife Office internet site. We believe that we went through an elaborate and extensive notification and outreach process to make the public aware of this proposal. Further, our efforts in this process satisfied the requirements of the Act and the Administrative Procedures Act (5 U.S.C. 551 *et seq.*) (APA) for promulgating Federal regulations regarding listing actions.

Comment 21: The broad scale of the proposed critical habitat maps are not specific enough to allow for reasonable public comment, therefore, violating the Act, the APA, and 50 CFR 424.12(c).

Our Response: Regulation 50 CFR 424.12(c) requires us to define critical habitat according to ''specific limits using reference points and lines as found on standard topographic maps of the area.'' We have done this by basing critical habitat legal descriptions on Universal Transverse Mercator (UTM) gridlines set every 328 feet (ft) (100 meters (m)). In addition to the legal descriptions, we also published maps providing an overview of the critical habitat boundaries in the proposed rule. While the **Federal Register** maps are only intended for illustrative purposes, we do provide more detailed critical habitat maps on request. These detailed maps show specific critical habitat areas of interest overlaid on 1:24,000 scale U.S. Geological Survey (USGS) topographic maps. Additionally, we developed an interactive internet site which shows vernal pool critical habitat boundaries overlaid on a 1:250,000 scale USGS topographic maps. The site allows users to pan to and magnify any area of interest. The Internet site was not completed by the September 24, 2002, publication date of the proposed rule, but we did direct interested parties who contacted us to the site when it became available on October 10, 2002, and posted information and a link to the internet site from our Sacramento Fish and Wildlife Office Internet site.

Issue 4—Property Rights

Comment 22: Several commenters stated that the designation will result in a loss of public property rights and will decrease land values.

Our Response: The designation of critical habitat does not affect land ownership or establish a refuge, preserve, or other special conservation area. It does not allow government or public access to private lands, and will not result in closure of private or State areas to all access or use. The designation of critical habitat on privately-owned land does not mean the government wants to acquire or control the land. Critical habitat does not require landowners to carry out any special management actions or restrict the use of their land. Activities on private lands that do not require Federal permits, funding, or authorization are not affected by the designation of critical habitat. Consequently, critical habitat should not result in effects to property rights, and as previously discussed, property values.

Comment 23: Several commenters expressed concern that the proposed rule and subsequent designation will have significant takings implications, and that the designation is a ''land grab'' by the Federal government and that the landowners should be compensated.

Our Response: As we discussed in the Takings section of our proposed rule, we believe that, in accordance with Executive Order 12630, the designation of critical habitat for the 15 vernal pool species will not have significant takings implications. Our conclusion was based on the results of an initial takings implication assessment in which we determined that: (1) The designation would result in little additional regulatory burden above that currently in place due to the 15 vernal pool species being federally listed because the majority of the designation is occupied by the species, and (2) the designation of critical habitat will not affect private lands in which there is not a Federal nexus. Consequently, we do not anticipate that property values, rights or ownership will be significantly affected by the critical habitat designation.

Comment 24: Several commenters expressed confusion regarding the types of agricultural activities and land use practices that, as a result of the designation, would may trigger a consultation under section 7 of the Act. Other commenters stated that the government will now oversee agricultural and ranching practices as a result of the Borden Ranch case (*Borden Ranch Partnership* v *U.S. Army Corps of Engineers* (9th Cir. 2001) 261F.3d 810,816.).

Our Response: Activities carried out, funded, authorized or permitted by a Federal agency (*i.e.*, Federal nexus) require consultation pursuant to section 7 of the Act if they may affect a federally listed species and/or its designated critical habitat. Our experience with consultations on the 15 listed vernal pool species is that few agricultural activities have involved a Federal nexus and have not required a consultation under section 7 of the Act. The Borden Ranch legal case, referenced above, involved the Clean Water Act and unauthorized fill of wetlands. Specifically, the activity that took place was not considered a routine agricultural practice, and thereby subject to regulation by the Army Corps of Engineers under the Clean Water Act. In regard to grazing, we do not foresee any change in the ability of private landowners to graze their property as a result of this designation. In addition, we anticipate that many activities, including grazing, presently occurring in areas designated as critical habitat can be managed to be compatible with the needs of vernal pool species and their habitat.

Issue 5—Mapping Methodology

Comment 25: Several commenters noted that the proposed critical habitat includes areas that do not contain the PCEs for the vernal pool crustaceans and vernal pool plants. This resulted in the following concerns: (a) That the boundaries of critical habitat should have been more precisely defined to exclude areas which obviously did not contain PCEs; (b) that private property would be affected by the designation even though it did not support the federally listed vernal pool species or

their PCEs; (c) that the designation would place a burden on landowners to refute the presumption that specific lands within critical habitat boundaries possess the PCEs of the species; (d) that we had incorrectly stated in the proposed rule that we would only designate areas containing the PCEs of the species; (e) that there was no biological justification for using a landscape-scale approach when more detailed information is available; and (f) that the designation, as proposed, was not in keeping with the requirement of the Act to ''narrowly define critical habitat.''

Our Response: As we have discussed in our response to Comment 21, we are required to define and delimit critical habitat ''by specific limits using reference points and lines as found on standard topographic maps of the area'' (50 CFR 424.12(c)). We have delimited the boundaries of critical habitat boundaries in this rule based on a minimum mapping scale of 100 meters. This mapping scale was based on the availability and accuracy of aerial photography and GIS data layers used to develop the designation. In drawing our lines for the proposed rule, we attempt to exclude areas that do not contain essential occurrences of the vernal pool species and habitat as defined by the PCEs. On the basis of information obtained through public comments and updated imagery and GIS data layers, we have been able to refine the boundaries of critical habitat during the development of this final rule. However, due to the limitations of our mapping scale, we were not able to exclude all areas that do not contain the PCEs. We have determined that existing man-made features and structures, such as buildings, roads, railroads, airports, runways, other paved areas, lawns, and other urban landscaped areas are not likely to contain one or more of the PCEs. Because activities in these areas are unlikely to affect PCEs (*i.e.*, essential habitat for the vernal pool species), a consultation under section 7 of the Act would not be required.

We disagree with the comment that private property will be adversely affected by the designation. Without any PCEs or presence of listed species, we regard that no adverse effects to private landowners will occur. If private landowners suspect or have listed vernal pool species and PCEs on their lands, those landowners may or may not chose to ascertain any biological information absent any fill of vernal pools that would require some consultation with us. We also disagree with the comment about our approach in designating critical habitat when additional detailed information is available. We used the best scientific and commercial information available to us. We opened two comment periods to obtain as much current information that is available to assist us in developing this final rule.

Comment 26: A number of commenters identified specific areas that they thought should not be designated as critical habitat.

Our Response: Where site-specific documentation was submitted to us providing a rationale as to why an area should not be designated critical habitat, we evaluated that information in accordance with the definition of critical habitat pursuant to section 3 (5)(A) of the Act and the provisions of section 4(b)(2) of the Act. Following our evaluation of the parcels we made a determination as to whether modifications to the proposal were warranted. In the preparation of the final rule, we further examined the area proposed and refined the critical habitat boundaries to exclude, where possible within the limitations of our minimum mapping scale, those areas that did not, or were not likely to, contain the PCEs for the 15 vernal pool species. We also excluded lands from the final designation that may contain vernal pool habitat, the vernal pool species, and the PCEs, but that we determined to not be essential to the conservation of the vernal pool crustaceans and vernal pool plants. Please refer to the Summary of Changes from the Proposed Rule section of this final rule for a more detailed discussion of changes and exclusion from the proposed rule.

Comment 27: Several commenters had specific concerns relating to the upland component of the PCEs. One commenter indicated that the upland component was not well defined and would result in additional costs and regulatory burdens.

Our Response: Upland areas adjacent to vernal pools are function as part of the localized watershed and are essential to maintaining the hydrological and ecological processes essential to the conservation of the listed vernal pool species. Upland areas buffer the effects of varying rainfall patterns and establish patterns of overland and groundwater flow which help determine the timing and duration of ponding and drying. Listed vernal pool species depend on intermittent periods of ponding and drying to prevent the establishment of strictly terrestrial or aquatic competitors. The timing and duration of such ponding and drying periods affects seed germination, and production of vernal pool plants, as well as the hatching and growth of vernal pool crustaceans. Upland areas also provide a major source of food, in the form of detritus, for vernal pool crustaceans; support pollinator populations for vernal pool plants; improve pond water quality by filtering sediment and contaminants; and moderate pond water temperature (*see* Background and Primary Constituent Elements sections).

We determined the extent of essential upland areas using the best available data, as required by the Act. Such data include topological and land use features useful for identifying natural watershed boundaries, (as shown by USGS Digital Orthorectified Quarter Quadrangles (DOQQs) and other aerial photography), information provided during the comment period, watershed boundaries identified in CALWATER (CALWATER 2.2), and information on the ecology and life history of the 15 vernal pool species (*see* Background section).

Comment 28: Several commenters suggested that the area being proposed as critical habitat for the vernal pool crustaceans and vernal pool plants represents the entire range of all the species, and that this broad of a designation is in violation of the Act. Other commenters stated that we have failed to provide adequate justification for why we determined that all areas proposed as critical habitat for the 15 vernal pool species are essential to their conservation. Further, it was also suggested that there was a lack of species occurrence information for the proposed, bring into question our justification for including these areas into our designation.

Our Response: In developing our proposal of critical habitat for the 15 vernal pool species, we identified those areas that, based on the scientific and commercial data available, we have determined contain essential occurrences of each of the species and/or are defined by the physical and biological features essential to their conservation. We used a number of criteria in defining critical habitat including, but not limited to, the known species occurrence and distribution data, habitat types, degree of habitat fragmentation, soil and landform relationships, connectivity and dispersal factors, and conservation biology principles. We did not include all vernal pool landscapes within each species' range even though surveys in these area may result in the detection of other occurrences. In developing the final rule, all the critical habitat units were reviewed and, where appropriate, further refined to ensure that nonessential habitat and areas not

containing the PCEs (where identifiable) were excluded from the final designation.

We recognize that not all specific areas designated as critical habitat are occupied by the vernal pool species addressed in this rule, in that we included portions of localized upland watershed areas that we have determined to be essential to the conservation of the vernal pool species and their habitat. However, these upland areas are within the geographic range occupied by each of the respective species resulting in our designation being in compliance with section 3(5)(A) of the Act.

Comment 29: One commentor believes that habitat monitoring results from Camp Roberts can be used to understand the effects of land use activities on other areas outside the military base.

Our Response: Following a review of the reports related to the habitat monitoring at Camp Roberts, we believe that the reports provide limited insight into the effects of land use activities off the base because the activities discussed in the reports are predominantly military specific such as the use of large, tracked military vehicles. Other studies addressed in the reports examine effects associated with grazing activities may have relevance to areas outside the base boundary. Results from these studies have been taken into consideration in the development of this designation.

Issue 6—Economic Analysis

Comment 30: Several commenters stated that the economic analysis fails to recognize other Federal funding (*e.g.*, farming subsidies) which may provide nexuses and therefore, resulting in the need for additional consultations triggered solely by the designation.

Our Response: The economic analysis focuses on the principle economic areas that could be potentially effected by the designation of critical habitat. In the preface of the economic analysis, we made an attempt to forecast the effects of future section 7 formal consultations resulting from the proposed designation of critical habitat. The 20-year future forecast was based on the history of formal consultation with Federal agencies occurring to date. Historically, we have had no consultations regarding vernal pool complexes, farming activities, and any nexus with the Farm Service Agency. However, if the Farm Service Agency were to fund, authorize, permit, or conduct activities that may adversely effect designated critical habitat, then they are required to consult with us pursuant to section 7 of the Act on those activities.

Comment 31: Several commenters stated that the economic analysis neglects to consider all impacts potentially resulting from the designation of critical habitat for the 15 vernal pool species. Specifically, commenters expressed concern that the economic analysis: (1) Minimizes potential impacts and costs that may result from the designation; (2) is based on unreasonable assumptions that are incomplete and outdated; (3) fails to analyze impacts on federally authorized water activities; and (4) understated the economic impact to the agricultural industry and ranching operations, and focused on urban effects to local economies and not that of the agricultural.

Our Response: In developing the draft economic analysis of the proposed designation, we attempted to provide the best analysis of the measured differences between the world with and without the designation of critical habitat for the 15 vernal pool species. Impacts considered in the analysis include costs associated with section 7 consultations for reasonably foreseeable activities, such as real estate development, highway construction and maintenance, and the supply and delivery of water. Data to predict reasonably foreseeable activities were obtained from proposed plans currently available to the public, discussions with staff at Federal and State agencies, and local governmental jurisdictions, and urban growth projections such as the California Urban Biodiversity Assessment (CURBA) model. Estimated costs associated with section 7 consultations are composed of both administrative costs and project modification costs. Indirect costs were also considered in the economic analysis, including costs associated with the delay of planned real estate development to address critical habitat issues as well as property value effects associated with regulatory uncertainty. The final economic analysis considered many of the comments submitted by the public and accordingly made several changes to the estimates of the above impacts. In addition, the final economic analysis also included a new component of potential economic impact—losses in consumer surplus that may be associated with a foreseeable reduction in the number of new homes built because of the designation. We disagree with the viewpoint that the economic analysis focuses on urban effects and not agriculture or rural effects. All effects were considered, however the greatest economic impact is likely to occur in those areas where land is constrained and less substitute land is available for economic activities that otherwise would destroy vernal pool habitat but for the designation of critical habitat. This assessment was based upon: (1) The history of formal consultations under section 7 of the Act, to date, on locations and activities that resulted in affects to vernal pool species and their habitat; and (2) because the majority of vernal pool habitat losses expected to occur within 20 years are anticipated to occur as a result land conversions from agricultural or rural to urban as the local economies develop and bid up the value land based on its best use.

Comment 32: Several commenters stated that the economic analysis does not assess impacts on proposed or permitted HCP/NCCPs.

Our Response: The economic analysis does not address the effects of designation of critical habitat on any permitted HCP, NCCP/HCP or proposed HCPs or NCCP/HCPs. We believe the designation of critical habitat for the 15 vernal pool species will not result in significant additional regulatory impacts to any currently permitted HCPs or NCCP/HCPs having covered federally listed vernal pool species. Those plans have sufficient biological conservation for covered vernal species and their aquatic and associated upland habitats to avoid adverse modification of critical habitat. Additionally, we believe that the proposed HCPs and NCCP/HCPs that cover vernal pool species also provide sufficient biological conservation of vernal pool species and their habitats to support the long-term vernal pool species conservation. Please refer to our discussion of HCPs under Relationship of Critical Habitat to Habitat Conservation Plans later in this rule.

Comment 33: Several commenters stated that the economic analysis does not assess cost of removal of critical habitat through future rule makings.

Our Response: The scope of our economic analysis to is to reasonably assess the potential cost that may result from the proposed designation so as to provide the Secretary information to be used in the development of this final agency action. We do not take into consideration any potential costs that may occur from future modification or revisions to this designation. Those potential costs, if the designation were to be revised, are not in the scope of this analysis and would be addressed at the time of the rulemaking for those revisions.

Comment 34: Several commenters stated that the economic analysis does not assess the costs to project

proponents who want to conduct activities on their lands that do not contain the PCEs.

Our Response: As indicated in this rule, we attempted to exclude lands from the final designation that do not contain the PCEs essential to the conservation of the 15 vernal pool species. Activities, for which there is not a Federal nexus, occurring on lands with the boundaries of designated critical habitat that do not effect the species and/or their PCEs would not result in a consultation pursuant to section 7 of the Act. Consequently, we would not anticipate that the designation of critical habitat in these areas would result in an increased regulatory burden or cost to the project proponent. In areas where a Federal nexus does not exist, these is not regulatory burden of critical habitat. As such, we would not anticipate that activities in these areas would result in a significant additional regulatory burden resulting from the designation.

Comment 35: Some landowners expressed concern that because their property was located within the proposed critical habitat designation they would be subject to additional constraints, costs and regulations under CEQA and NEPA. The commenters further expressed that the draft economic analysis inaccurately characterized impact that would result from both CEQA and the National Environmental Policy Act (NEPA) following the designation of critical habitat for the 15 vernal pool species.

Our Response: According to section 15065 (California Code of Regulations Title 14, Chapter 3) of CEQA guidelines, environmental impact reports are required by local lead agencies when, among other things, a project has the potential to ''reduce the number or restrict the range of an endangered, rare or threatened species.'' Because nine of the 11 vernal pool plants are either State listed endangered or threatened, and federally listed species are presumed to meet the CEQA definition of ''endangered, rare or threatened species'' under 15380 (California Code of Regulations Title 14, Chapter 3), no significant additional constraints, or costs, should result from the designation of critical habitat beyond those now in place for all federally listed species, including the 15 vernal pool species in this rule.

We believe that we made the best 20-year estimation of what the added costs would be from impacts of the designation of critical habitat for the 15 vernal pool species. Under both the environmental review processes of CEQA and NEPA, a project proponent is required to identify biological resources or conduct an environmental assessment, including any designated critical habitat on proposed project sites, and identify any significant environmental effects to those resources that could result from the project. The processes also need to be disclosed and have opportunities for public comments. We believe that the economic analysis accurately assesses the impacts to State and Federal regulatory processes.

Comment 36: One commenter stated that, contrary to our assumption in the draft economic analysis, the Los Angeles District Office of the Corps may take regulatory jurisdiction over vernal pools that occur within their geographic jurisdication.

Our Response: The economic analysis made the assumption that the Los Angeles District may not take jurisdiction of the vernal pools that are in critical habitat for the vernal pools within their watershed-based jurisdiction based on conversations with the representatives from the Los Angeles District Office of the Corps. We believe that the Corps has the discretion of whether or not to take jurisdiction of any waters of the United States. The consequences of this discretion may increase or decrease the number of formal consultations and associated costs that may occur over the next 20 years. We made the best estimate of the number of formal consultations and their associated costs that we may have over the next 20 years based upon our history of formal consultations with the Corps across the range of the 15 vernal pool species.

Comment 37: Several commenters stated that the economic analysis should be completed and made available concurrently with the proposal to designate critical habitat, and that critical habitat should not have been proposed before an economic analysis of the proposal was complete.

Our Response: Pursuant to Act and clarified in our implementing regulations at 50 CFR 424.19, we are required to, ''after proposing designation of such an area, consider the probable economic and other impacts of the designation upon proposed or ongoing activities.'' Following the publication of our prosed designation of critical habitat for the 15 vernal pool species, we developed a draft economic analysis of the proposed designation that was released for public review and comment. The analysis was subsequently revised based on public comment and other information made available to us and a final economic analysis was produced. This final analysis was used to assist us in developing the final designation. Consequently, we believe that we have interpreted the regulations and process correctly. Please refer to the draft and final economic analyses for this rulemaking for more detailed discussions of the methods employed in the analysis and the results.

Comment 38: Several commenters stated that the economic analysis estimates far too few section 7 consultations under the Act.

Our Response: After using our historical database of section 7 consultations, and speaking with numerous Federal agencies about the likelihood of future consultations after critical habitat is designated, we believe that we correctly and reasonably estimated the number of section 7 consultations that would occur despite the lack of certainties about 20-year growth models used to predict urban growth, multiple uses of open space that includes vernal pool preservation areas, the lack of a fixed amount of upland habitat associated with vernal pool complexes, and the locally variable values of non-residential lands.

Comment 39: Several commenters stated that the CURBA model underestimates the growth and costs associated with the impacts of critical habitat designation for the 15 vernal pool species.

Our Response: We used the CURBA model, along with information from interviews with representatives of Federal agencies, county and local government planning officials, information we had on the number of completed formal consultations, and those consultations that were initiated but not completed, to improve our attempt to correctly estimate the number and costs of formal consultations within the next 20 years. Based upon additional discussions with these representatives from the above-mentioned entities, we have revised upward the number of informal consultations from 240 to 470, and decreased the number of formal consultations from 235 to 157. Because, the pace of development in any region fluctuates broadly from year to year due to the unevenness in market timing and planning practices, the CURBA model offers a more standard method of forecasting the acreage required to accommodate new growth throughout the proposed critical habitat area.

Comment 40: Several commenters stated that the economic analysis should focus on the potential costs attributable solely to critical habitat and not on the costs associated with the listing of the species.

Our Response: In developing our draft economic analysis, we attempted to differentiate between the costs attributed to the proposed designation of critical habitat from those attributable to the species being federally listed. These impacts are presented and discussed in our draft economic analysis and the final economic analysis. However, as discussed below in response to Comment 41, the methodology of our economic analysis is consistent with the 10th Circuit Court's instructions to make our economic analyses of critical habitat meaningful, which in the Court's mind, requires the economic analysis to consider all of the potential costs associated with the designation of critical habitat, regardless of whether or not those costs are co-extensive with other parts of the Act. As a result, our economic analysis now also consider the total costs associated with section 7 of the Act. Please refer to our draft and final economic analyses for a more thorough discussion of the methodology employed in the our analysis.

Comment 41: The economic analysis not done in a manner consistent with the *New Mexico Cattle Growers Association* v. *U.S. Fish and Wildlife Service,* 248 F. 3d 1277 (10th Cir. 2001) decision.

Our Response: In this 10th Circuit Court case, the court instructed us to conduct a full analysis of all the economic impacts of critical habitat designation, regardless of whether or not those impacts are attributable co-extensively to other causes. In order to ensure that no costs of the proposed designation are omitted, the economic analysis for the 15 vernal pool species examined and fully considered all potential effects associated with all section 7 consultation effects in or near proposed critical habitat. In doing so, the economic analysis ensures that any critical habitat impacts that are co-extensive with the listing of the species are not overlooked. As a result of this approach, the economic analysis may likely overstate the regulatory effects under section 7 of the Act that are attributable to the proposed designation of critical habitat. Therefore, we believe that our analysis has been done in compliance with the Court's decision. Please refer to the draft and final economic analyses for a more detailed discussion of this issue.

Comment 42: Several commenters stated that the assumptions in the DEA suggesting that the designation of critical habitat for the 15 vernal pool species is not expected to result in significant restrictions in addition to those currently in place due to the species already being federally listed are flawed.

Our Response: In the proposed rule and DEA, we indicated that we do not expect that the designation of critical habitat would result in significant additional regulatory or economic burdens or restrictions incremental to those afforded the species pursuant to being listed under the Act. This assertion is based on the regulatory protections afforded the 15 vernal pool species from them being federally listed under the Act, and the fact that the majority of the lands designated as critical habitat are considered occupied by the species.

Comment 43: One commenter stated that the DEA failed to adequately consider the effect the proposed rule could have on the development community.

Our Response: The DEA discussed the potential impact the proposed rule could have on the development community. Specifically, the analysis discussed how the proposal would not impose any significant additional economic impacts beyond those currently in existence for occupied areas of critical habitat. We acknowledged that critical habitat designation could have slight effects on certain industries such as real estate development, farming, and ranching. But the biggest effects to these industries result from the impact their activities have on the vernal pool crustaceans, which are afforded protection due to their status as federally protected threatened or endangered species. Because the majority of critical habitat units are currently occupied by the vernal pool crustaceans or vernal pool plants, we do not expect any significant increase in consultations or related project delay or costs to be attributable to the designation of critical habitat.

Comment 44: Several commenters stated that the DEA was biased because it analyzed costs and not benefits, and that it should further expand on the value of protecting vernal pool habitats. Several commenters stated that the DEA overestimates costs. One commenter stated that the development industry would simply avoid those areas which would require compensation for vernal pool habitats focusing their efforts on adjacent properties, thus minimizing costs associated with the designation.

Our Response: There may be many opinions as to a particular species' contribution to society, including their aesthetic, scientific, or other significant contribution. However, placing a specific monetary value on endangered species, critical habitat, and other non-consumptive environmental or natural systems is subjective and not quantifiable in terms of economics. Although the recreational use aspect of natural areas can be identified, the economical benefit of a species' existence in relation to a monetary figure cannot be analyzed. The final economic analysis has taken into account the factor that the development industry would simply avoid areas which had habitat for the vernal pool crustaceans and vernal pool plants.

Comment 45: Numerous commenters said that the designation would greatly increase the costs (surveys, consultant fees, habitat compensation fees, land acquisition, etc.) and regulatory burden (California Environmental Quality Act (CEQA), section 7 or section 10 of the Act, section 404 of the Clean Water Act (CWA), etc.) on landowners and local governments, as well as delays in permit processing and issuance of biological opinions. These cost and burdens would have a negative impact on ranching/farming activities, local economies, the development industry, and personal income. A few commenters stated that we should pay for any increased costs required for surveying.

Our Response: In the development of the draft and final economic analyses for this rulemaking, our economist evaluated potential economic effects of the issues raised by the commenters that could potentially result from the proposed designation, as well as the co-extensive costs associated with the species being federally listed. Please refer to both the draft and final economic analyses for a more thorough discussion of how these issues were addressed. Additionally, while our analysis did show that approximately $23.4 million per year would be attributed to the designation, it is small in comparison to the value of new construction activities in the affected counties, which amounted to over $19 billion in 2000 alone. Critical habitat designation only affect actions with a Federal nexus, so any actions carried out on non-Federal lands without Federal funding, permitting, or authorization should not be affected. Further, critical habitat designation may actually reduce delays and help prevent the possibility of arbitrary biological opinions by establishing the habitat needs of the species prior to the evaluation of specific projects. By alerting the public to those habitat needs during the critical habitat designation process, we may also help to avoid unpleasant surprises for people who might not otherwise have been aware of the need to take section 7 considerations into account.

Comment 46: Dr. David Sunding, University of California, Berkeley, submitted an alternate economic analysis of our proposed designation of critical habitat for the 15 vernal pool species that questioned the accuracy and robustness of our draft economic analysis.

Our Response: We have thoroughly reviewed and address the substantive issues and concerns raised by Dr. Sunding's in his analysis in the final economic analysis for this rulemaking. Please refer to that document for a detailed discussion of Dr. Sunding's analysis and our responses.

Issue 7—Procedural Concerns

Comment 47: One commenter stated that we violated the Commerce Clause power and exceeded our jurisdiction by regulating species which are in no way involved in interstate commerce.

Our Response: The Federal government has the authority under the Commerce Clause of the U.S. Constitution to protect these species, for the reasons given in Judge Wald's and Judge Henderson's concurring opinion in *Nat'l Ass'n of Home Builders* v. *Babbitt*, 130 F.3d 1041 (D.C. Cir. 1997), cert. denied, 1185 S. Ct. 2340 (1998). See also *Gibbs* v. *Babbitt*, No.99–1218 (4th Cir. 2000). The Home Builders case involved a challenge to application of Act prohibitions to protect the listed Delhi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*). As with the species at issue here, the Delhi Sands flower-loving fly is endemic to only one State. Judge Wald held that application of the Act to this fly was a proper exercise of Commerce Clause power because it prevented loss of biodiversity and destructive interstate competition.

Comment 48: One commenter stated that since the we identified the proposed rule as a significant regulatory action under Executive Order 12866, we violated it by: (1) Not submitting the economic analysis to the Office of Information and Regulatory Affairs (OIRA) along with the proposed rule prior to publication in the **Federal Register**; (2) not allowing a 60-day review period for the economic analysis; (3) not identifying changes made to the proposed rule as a result of the economic analysis; and (4) not considering the economic analysis during the proposed designation process.

Our Response: Because this rulemaking is subject to a court imposed deadline, section 6(a)(3)(D) of Executive Order 12866 allows us to comply ''to the extent practicable'' with OIRA submission requirements (commenter's point 1). We have done so by submitting both the proposed rule and the economic analysis to OIRA for review as soon as was possible prior to publication. It was not practicable to complete the economic analysis prior to publication of the proposed rule, but we did complete it and utilized it in reaching this final designation (commenter's point 4).

With regard to the length of the comment period following publication of the economic analysis (commenter's point 2), section 6(a)(1) of Executive Order 12866 states that we ''should, afford the public a meaningful opportunity to comment on any proposed regulation, which in most cases should include a comment period of not less than 60 days.'' The proposed regulation in this case is the proposed critical habitat designation, not the economic analysis. We provided a total of 104 days for the public to comment on the proposed critical habitat designation. Of those 104 days, 47 were after publication of the notice of availability of the economic analysis on November 21, 2002 (67 FR 70201).

With regard to the identification of changes made to the proposed rule (commenter's point 3), paragraphs 6(a)(3)(E)(ii) and (iii) of the Order require us, subsequent to publication of a proposed rule, to identify any substantive changes made to the proposed rule between submission to OIRA and to the public. We made no substantive changes to the proposed rule during that time period. Substantive changes made to the rule following public review and comment are addressed in the Summary of Changes from the Proposed Rule section of this final rule.

Comment 49: One commenter stated that due to the U.S. Supreme Court ruling in *Solid Waste Agency of Northern Cook County* v *United States Army Corp of Engineers* (2001) 531 U.S. 159 (SWANCC), we do not have the authority to list species or implement regulatory actions related to such listings in isolated vernal pools.

Our Response: The SWANCC decision pertained to the Corps and their authority under the Clean Water Act to take regulatory jurisdiction over wetlands which may be isolated from navigatable waters. The 15 vernal pool species will continue to receive the protections afforded them under the Act, including designation of critical habitat, regardless of whether vernal pools are determined to be regulated as waters of the United States under the Clean Water Act.

Comment 50: One commenter stated that we failed to comply with prescribed procedures mandated by the APA by not providing access to the administrative record for the proposed rule and economic analysis.

Our Response: In the proposed rule, we stated that all supporting documentation, including the references and unpublished data used in the preparation of the proposed rule, would be available for public inspection at the Sacramento Fish and Wildlife Office. A public viewing area was made available at the Sacramento Fish and Wildlife Office where the proposed critical habitat units, superimposed on 7.5 minute topographic maps, could be inspected. In addition, we responded to each request for GIS maps and data supporting the rulemaking in a timely manner by providing copies of detailed maps and data specific to their needs. Additionally, data concerning the occurrences of the vernal pool crustaceans and vernal pool shrimp used in the analysis for the proposed designation were also made available to the public, if requested. Therefore, we believe that we have complied with provisions of the APA as it relates to this rulemaking.

Summary of Changes From the Proposed Rule

On the basis of a review of public comments received on the proposed designation of critical habitat and DEA for the 4 vernal pool crustaceans and 11 vernal pool plants in California and southern Oregon, we reevaluated our proposed critical habitat designation and made changes as necessary. In the development of our final designation of critical habitat for these 15 vernal pool species, we considered new information provided to our office after the proposed designation was published.

The refinements to the amount of land determined to be essential for the 15 vernal pool species and incorporated into this final designation resulted in a net reduction of approximately 466,504 ac (186,601 ha) of land. Most of the units received some refinement, and a few were divided into subunits depending on the amount of nonessential lands that were removed. Information regarding the extent of the changes from the proposed rule in the individual units is in the unit descriptions for each species and acreage tables.

The common name for the species *Castilleja campestris* ssp. *succulenta* was changed in the final rule (from succulent owl's-clover to fleshy owl's-clover) to reflect the name used under the listing of the species (Service 1997a). This was done to avoid

confusion between species listing and the designation of critical habitat.

Following publication of the proposed critical habitat rule for the 15 vernal pool species (67 FR 59884), we re-evaluated the proposed critical habitat for each of the species to ensure that the areas within the designation were essential to the conservation of the species (*see* Methods section below).

In the majority of instances, we continued to used the 328 ft (100 m) grid in determining the legal boundaries for the critical habitat. As a result, some areas not containing the PCEs may still be within the critical habitat boundary. Because these areas do not have one or more of the PCEs for the 15 species, the landowners would not be required to consult as a result of this determination. In some areas where precise boundaries were required as a result of land ownership exclusions, or for small areas surrounded by nonessential habitat, we used a 32.8 ft (10 m) grid for further refinement. However due to time limits, staffing, and funding required for completion of this rule, we were not able to use the finer detailed 32.8 ft (10 m) grid for all the critical habitat boundaries.

We excluded the U.S. Fish and Wildlife Service owned lands within the boundaries of the Kern, Sacramento, San Francisco Bay, and San Luis National Wildlife Refuges and National Wildlife Refuge Complexes and the Coleman National Fish Hatchery. The total amount of refuge and hatchery land excluded totals approximately 33,097 ac (13,238 ha). We also excluded California Department of Fish and Game owned lands within the Battle Creek, Big Sandy, Grizzly Island, Hill Slough, North Grasslands, and Oroville Wildlife Areas and State-owned lands within Allensworth, Boggs Lake, Butte Creek Canyon, Calhoun Cut, Carrizo Plains, Dales Lake, Fagan Marsh, Phoenix Field, San Joaquin River, Stone Corral, and Thomes Creek Ecological Reserves. The total amount of land excluded for State-owned lands excluded within wildlife areas or ecological reserves is approximately 20,933 ac (8,373 ha). These areas were excluded based on the benefits of inclusion verses the benefits of exclusion and from information received from the California Department of Fish and Game. We have determined that the benefits of exclusion outweigh the benefits of inclusion for these areas (*see* Effects of Critical Habitat Section below).

We also excluded four military installations, three areas with HCPs, and one area containing Tribal lands. Based on information received from the military installations and the Tribal entity, we have determined that the benefits of exclusion outweigh the benefits of inclusion for these five areas (*see* Effects of Critical Habitat Section below). The total amount of land excluded is approximately 64,803 ac (25,921 ha). The specific land area for each exclusion is outlined below and in the tables.

The four military installations include Beale AFB (5,028 ac (2,011 ha) excluded) in Yuba County, Travis AFB (5,089 ac (2,036 ha) excluded) in Solano County, Fort Hunter Liggett (16,298 ac (6,519 ha) excluded) in Monterey County, and Camp Roberts (33,117 ac (13,247 ha) excluded) in San Luis Obispo and Monterey Counties, totaling approximately 59,532 ac (23,813 ha) excluded for all four military bases. The species affected as a result of this determination include: the vernal pool fairy shrimp, vernal pool tadpole shrimp, Conservancy fairy shrimp, *Tuctoria mucronata, Neostapfia colusana,* and *Lasthenia conjugens.*

In comparing the benefits of inclusion of critical habitat for the species versus benefits of exclusion of these areas, we determined that it is appropriate to exclude these military installations from this critical habitat designation under section 4(b)(2). The main benefit of this exclusion is ensuring that military training activities can continue without interruption while the INRMPs move toward full implementation. One of the management strategies for each INRMP on the four bases is to establish guidance for the conservation of vernal pool ecosystems and the species inhabiting them. We have been working closely with the various military installations to finalize the INRMPs and have made significant progress toward conservation of the resources at these facilities. In addition, after re-evaluating the habitat associated with the proposed designation and making changes to the critical habitat unit boundaries, the actual amount of habitat on several of the bases was reduced since the habitat did not contain the PCEs for the species. We expect that when the INRMPs are completed and adopted in the near future, they will provide equal or greater protection to vernal pool species habitat than a critical habitat designation.

As described in the proposed rule, the area within the proposed Unit 35 for vernal pool fairy shrimp in Riverside County may be subject to exclusion. After further evaluation, we determined that the area known as the Skunk Hollow critical habitat unit is appropriate for exclusion based on the determination that the special management considerations and protections afforded by its inclusion in a reserve established within an approved mitigation bank in the Rancho Bella Vista Habitat Conservation Plan area.

Although the vernal pool fairy shrimp is not expressly covered by the Assessment District 161 Subregional HCP (AD161 HCP), we believe that management actions undertaken in the Skunk Hollow watershed to benefit the endangered Riverside fairy shrimp, threatened *Navarretia fossalis* (spreading navarretia), and the endangered *Orcuttia californica* (California Orcutt grass)—all of which are included as covered species under the HCP—will provide equal conservation benefits for the vernal pool fairy shrimp. The total area excluded for vernal pool fairy shrimp as a result of this exclusion is approximately 239 ac (97 ha).

We are also excluding Unit 33 (Hemet-San Jacinto Unit ABC) and Unit 34 (Santa Rosa Plateau Unit) of the vernal pool fairy shrimp critical habitat based on section 4(b)(2) of the Act. The habitat within Unit 33 is included in the Draft Western Riverside HCP which will provide protections for the species and habitat. Vernal pools within the Santa Rosa Plateau Ecological Reserve, including those in Unit 34, are conserved and managed for the benefit of the species that occur within the vernal pools and surrounding watersheds. Exclusion of units 33 and 34 from vernal pool fairy shrimp critical habitat will not result in the extinction of the species. The removal of these units from critical habitat designation reduces the total amount of critical habitat designated for the species by approximately 8,425 ac (3,370 ha).

Similarly, a small portion of the area within the proposed vernal pool fairy shrimp critical habitat (Unit 18) in San Joaquin County also has an approved and legally operative NCCP/HCP (San Joaquin Multi-Species Conservation Plan), which includes measures for the conservation of these two species. It would be appropriate to exclude these units. The total amount of area excluded for vernal pool fairy shrimp as a result of this exclusion is approximately 141 ac (56 ha).

We proposed critical habitat on Tribal lands of the Mechoopda in Butte County, although at that time we were unaware that these were Tribal lands. The Mechoopda brought this to our attention during the comment period and requested that their lands be excluded from the final designation. We evaluated the lands proposed as critical habitat and find that the benefits of excluding these areas from critical habitat designation outweigh the

benefits of including these areas. The Mechoopda Tribe submitted a management plan that provides for special management considerations or protections for listed vernal pool species. The Tribe demonstrated its commitment to ensuring the long-term viability of federally listed species on Tribal lands by implementing appropriate conservation measures that will contribute to species' long-term survival by ensuring the conservation of vernal pool resources on Tribal property. The approximate amount of land which the Mechoopda Tribe requested to exclude is approximately 645 ac (260 ha). The proposed critical habitat for the area included habitat for the vernal pool tadpole shrimp (Unit 4). The benefits of including the Tribe's land are limited to minor educational benefits, since the Tribe has committed to consult with us on any effects to the species. The benefits of excluding these areas from being designated as critical habitat are more significant, and include encouraging the continued development and implementation of special management measures. The exclusion of critical habitat for the Mechoopda trust lands is consistent with our published policies (Secretarial Order 3206, Presidential Memorandum dated April 29, 1994: Government-to-Government Relations with Native American Tribal Governments (May 4, 1994, 59 FR 22951)) on Native American natural resource management because this exclusion allows the Tribe to manage its own natural resources.

Finally, as a result of comments received, we made editorial changes to the sections of the rule pertaining to the methods used, the PCEs, the criteria used to identify critical habitat, and the unit descriptions for all 15 vernal pool species. We made these changes to eliminate redundancy, improve clarity, and provide a more in-depth explanation of the biological necessity of the designation for the 15 vernal pool species.

Critical Habitat

Critical habitat is defined in section 3 of the Act as: (i) The specific areas within the geographic area occupied by a species at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. ''Conservation,'' as defined by the Act, means the use of all methods and procedures that are necessary to bring an endangered or a threatened species to the point at which listing under the Act is no longer necessary.

Section 7(a)(2) of the Act requires that Federal agencies shall, in consultation with us, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat. Section 7 also requires conferences on Federal actions that are likely to jeopardize the continued existence of any species proposed to be listed or result in the destruction or adverse modification of critical habitat proposed to be designated for such species. Aside from the added protection that may be provided under section 7, the Act does not provide other forms of protection to lands designated as critical habitat. Consultation under section 7 of the Act does not apply to activities on private or other non-Federal lands that do not involve a Federal nexus, and consequently critical habitat designation does not afford any additional regulatory protection under the Act under those circumstances.

In order to be included in a critical habitat designation, the habitat must be essential to the conservation of the species. Critical habitat designations identify, to the extent known and using the best scientific and commercial data available, habitat areas that provide essential life-cycle needs of the species (*i.e.*, areas on which are found the PCEs, as defined at 50 CFR 424.12(b)).

Section 4 requires that we designate critical habitat for a species, to the extent such habitat is determinable, at the time of listing. When we designate critical habitat at the time of listing or under short court-ordered deadlines, we may not have sufficient information to identify all the areas essential for the conservation of the species or, alternatively, we may inadvertently include areas that later will be shown to be nonessential. Nevertheless, we are required to designate those areas we know to be critical habitat, using the best information available to us. Section 4(b)(2) of the Act requires that we take into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat. We may exclude areas from critical habitat designation when the benefits of exclusion outweigh the benefits of including the areas within critical habitat, provided the exclusion will not result in extinction of the species.

Within the geographic area occupied by the species, we will designate only areas currently known to be essential. Essential areas already have the features and habitat characteristics that are necessary to sustain the species. If the information available at the time of designation does not show that an area provides essential life-cycle needs of the species, then the area should not be included in the critical habitat designation.

Our regulations state that ''The Secretary shall designate critical habitat outside the geographic areas presently occupied by the species only when a designation limited to its present range would be inadequate to ensure the conservation of the species'' (50 CFR 424.12(e)). Accordingly, when the best available scientific and commercial data do not demonstrate that the conservation needs of the species require designation of critical habitat outside of occupied areas, we will not designate critical habitat in those areas outside.

Our Policy on Information Standards Under the Endangered Species Act, published on July 1, 1994 (59 FR 34271), provides criteria, establishes procedures, and provides guidance to ensure that our decisions represent the best scientific and commercial data available. It requires us, to the extent consistent with the Act, and with the use of the best scientific and commercial data available, to use primary and original sources of information as the basis for recommendations to designate critical habitat. When determining which areas are critical habitat, a primary source of information should, at a minimum, be the listing package for the species. Additional information may be obtained from recovery plans, articles in peer-reviewed journals, conservation plans developed by States and Ccunties, scientific status surveys and studies, biological assessments, unpublished materials, and solicited expert opinion.

Section 4 of the Act requires that we designate critical habitat based on what we know at the time of the designation. Habitat is often dynamic, and species may move from one area to another over time. Furthermore, we recognize that designation of critical habitat may not include all of the habitat areas that may eventually be determined to be necessary for the conservation of the species. For these reasons, all should understand that critical habitat designations do not signal that habitat outside the designation is unimportant or may not be required for the conservation of the species. Areas outside the critical habitat designation will continue to be subject to conservation actions that may be

implemented under section 7(a)(1), the regulatory protections afforded by the section 7(a)(2) jeopardy standard, and the applicable prohibitions of section 9 of the Act, as determined on the basis of the best available information at the time of the action. Federally funded or assisted projects affecting listed species outside their designated critical habitat areas may still result in jeopardy findings in some cases. Similarly, critical habitat designations made on the basis of the best available information at the time of designation should not control the direction and substance of future recovery plans, HCPs, or other species conservation planning efforts if new information available to these planning efforts calls for a different outcome.

The action of designating critical habitat does not automatically lead to recovery of a listed species, but it may contribute to species long-term conservation. Critical habitat units are not preserve areas; designation does not target and establish specific preserves and their boundaries. Critical habitat is designated to make Federal agencies aware that these areas are critical to the species. Although the designation of critical habitat can identify areas where a variety of conservation strategies may be developed to ensure the survival and recovery of target species, the development of these strategies are most appropriately taken through local planning efforts, such as the development of HCPs. The action of designating critical habitat does not result in the creation of management plans, establish numerical population goals, or prescribe specific management actions, whether inside or outside of such designated critical habitat. Specific management recommendations for areas designated as critical habitat are most appropriately addressed in recovery, conservation, and management plans, and through consultations and permits under section 7 and section 10 of the Act.

Prudency Determination

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12) require that, to the maximum extent prudent and determinable, we designate critical habitat at the time the species is determined to be endangered or threatened. Our regulations (50 CFR 424.12(a)(1)) state that designation of critical habitat is not prudent when one or both of the following situations exist—(1) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of such threat to the species, or (2) such designation of critical habitat would not be beneficial to the species. At the time of the final listing determinations (62 FR 34029; 62 FR 14338; 59 FR 48136; 57 FR 24192), we found that designation of critical habitat was not prudent for the vernal pool crustaceans and plants (excluding *Tuctoria mucronata*). At the time of final listing of *Tuctoria mucronata* (43 FR 44810), we did not make any determination about whether or not designation of critical habitat was prudent.

However, in the past few years, several of our determinations that the designation of critical habitat would not be prudent have been overturned by court decisions. For example, in *Conservation Council for Hawaii* v. *Babbitt,* the United States District Court for the District of Hawaii ruled that the Service could not rely on the ''increased threat'' rationale for a ''not prudent'' determination without specific evidence of the threat to the species at issue (2 F. Supp. 2d 1280 [D. Hawaii 1998]). Additionally, in *Natural Resources Defense Council* v. *U.S. Department of the Interior,* the United States Court of Appeals for the Ninth Circuit issued a ruling that limited the application of the no benefit justification and required the Service to balance the potential threats against any benefits to the species of designating critical habitat 113 F. 3d 1121, 1125 (9th Cir. 1997).

The courts also have ruled that, in the absence of a finding that the designation of critical habitat would increase threats to a species, the existence of another type of protection, even if it offers potentially greater protection to the species, does not justify a not prudent finding (*Conservation Council for Hawaii* v. *Babbitt* 2 F. Supp. 2d 1280).

On the basis of these court decisions and the decision specific to these species, we have re-evaluated our original prudency determinations for the 14 vernal pool species for which we had made a determination, using the information available at the time we made our final listing decisions and that which has become available since. We further evaluated the prudency of designation critical habitat for *Tuctoria mucronata* in light of these court decisions.

If critical habitat is designated for the 15 vernal pool species, Federal agencies will be required to consult with us on actions they carry out, fund, permit, or authorize, to ensure that their actions will not destroy or adversely modify critical habitat . It may also provide information to Federal agencies and the general public of the importance of the vernal pool species and their habitat and the need for special management considerations or protection. A critical habitat designation may assist Federal agencies in planning future actions because it establishes, in advance, those habitats that will be reviewed in section 7 consultations.

We have determined that the instances of likely vandalism, discussed in the final listing rules as the rationale for why we did not believe critical habitat to be prudent, though real, have been relatively isolated since the species have been listed. Consequently, we conclude that designating critical habitat will not increase incidences of habitat vandalism above current levels for these species. Accordingly, we withdraw our previous determinations that the designation of critical habitat is not prudent. We find that designation of critical habitat is prudent and determinable for the 15 vernal pool species addressed herein because there is not likely to be increased threats to the species that may result from the critical habitat designation. Therefore, we are subsequently designating critical habitat for the four vernal pool crustaceans and 11 vernal pool plants in this final rule.

Methods

As required by section 4(b)(2) of the Act and regulations at 50 CFR 424.12, we are to use the best scientific and commercial data available to determine areas that contain the physical and biological features essential for the conservation of the 15 vernal pool species. This included data and information contained in, but not limited to, the final rules listing the 15 species addressed herein, the Vernal Pools of Southern California Final Recovery Plan (Service 1998), the Delta Green Ground Beetle and Solano Grass Recovery Plan (Service 1985), the California Vernal Pool Assessment Preliminary Report (Keeler-Wolf 1998), Report of Science Advisors for the Eastern Merced County Natural Community Conservation Plan Habitat Conservation Plan (Noss *et al.* 2002a), research and survey observations published in peer reviewed articles, vernal pool mapping and other data collected for the development of HCPs, reports submitted by biologists holding section 10(a)(1)(A) recovery permits, biological assessments provided to us through section 7 consultations, data collected for the development of a Wetland Conservation Plan in Oregon, reports and documents that are on file in our field offices, and personal discussions with experts outside of our agency with extensive knowledge of vernal pool species and habitats.

The critical habitat units were delineated by using ArcView (Environmental Systems Research Institute, Inc.), a computer GIS program to evaluate GIS data derived from a variety of Federal, State, and local agencies, and from private organizations and individuals. Data layers included current and historic species occurrence locations (CNDDB 2002), mapped vernal pool grassland habitats (Holland 1998, 2003), and/or other vernal pool location information. We presumed occurrences identified in CNDDB to be extant unless there was affirmative documentation that an occurrence had been extirpated. We also relied on unpublished species occurrence data contained within our files including section 10(a)(1)(A) reports and biological assessments. These data layers were then mapped onto SPOT imagery (satellite aerial photography) (CNES/SPOT Image Corporation 1993–2000) for each vernal pool region identified by Keeler-Wolf *et al.* 1998 to help us identify which specific areas contained the vernal pool species and their habitat.

We then evaluated the areas defined by the overlap of the combined coverages (data layers) to initially focus on which areas may provide those physical and biological features essential to the conservation of the 15 vernal pool species. The areas were further refined by using satellite imagery, watershed boundaries, geologic landform coverages, elevational modeling data, soil type coverages, vegetation/land cover data, and agricultural/urban land use data to eliminate areas that did not contain the appropriate vegetation or associated native plant species, as well as features such as cultivated agriculture fields, housing developments, and other areas that are unlikely to contribute to the conservation of the 15 vernal pool species. Each of the factors identified above had a bearing on the total size and spatial configuration of the conglomeration of units for each species, as well as the size and location of each of the individual units. Whenever possible, geographic features (*e.g.*, ridge lines, valleys, streams, plateaus, geologic formations, shorelines, etc.) or manmade features (*e.g.*, roads or obvious land use) that created an obvious boundary for a unit were used as unit area boundaries.

The resulting delimited areas or lands for each species were then considered to define all habitat for that species, including occupied and unoccupied habitat. These lands were further evaluated to determine which of specific areas are essential to the conservation of each of the 15 listed vernal pool species. Several tools were used to assist us in delineating the specific areas that we believed to contain the primary constituent elements for each species and therefore essential to the species' conservation. These included: (1) Generally accepted conservation biology principles as described below; (2) information in recovery plans covering the subject species; (3) peer reviewed, published literature; (4) expert opinion for each of the species. The resulting areas were subsequently proposed as critical habitat for the 15 vernal pool species.

Following publication of the proposed critical habitat rule for the 15 vernal pool species (67 FR 59884), we re-evaluated the lands proposed based on information received during the public comment period, from local habitat and species experts, or otherwise made available to us. We also used updated detailed aerial photography provided by county planning departments, and DOQQs from the USGS. In Merced County, local experts including National Wildlife Refuge and CDFG biologists were consulted to identify and verify habitat areas. We also visited selected locations to determine if they contained the PCEs.

Because the minimum mapping unit of the Holland (1998) vernal pool habitat data was 40 ac (16 ha), and the resolution of the SPOT imagery did not allow us to identify all vernal pool habitat, we refined unit boundaries based on additional GIS data layers when necessary and available, including soils information from the Soil Survey Geographic data bases (U.S. Department of Agriculture (USDA) 1998–2001), and the California State Soil Geographic data bases (USDA 1994). We used geologic information developed by the California Department of Mines and Geology (2000) and Liss (2001). To identify the extent of flat or gently sloping topography where vernal pools are found, we evaluated Digital Elevation Models from the USGS (2000).

We also used a number of local GIS data sets for specific areas, including information developed through the Riverside Multiple Species HCP and the Vernal Pools of Southern California Final Recovery Plan (Service 1998), habitat mapping for Butte County (U.S. Environmental Protection Agency (EPA) 1994), Tehama County (2001), Shasta County (2001), Placer County (Glazner 2001), Solano County (2000), Yolo County (1995), Sacramento County (1999), and San Joaquin County (2000) in California, and by the Rogue Valley Council of Governments in Oregon (Evans 2000). Other smaller scale mapping efforts were reviewed from Solano County Farmlands and Open Space (2000) and East Bay Regional Parks District (2001). Aerial photographs for eastern Merced County were used to determine habitat conditions. The specific layers used and the methodology employed for each unit is described within the Unit Descriptions section. To determine land ownership within each unit, we used data from the State of California (Davis *et al.* 1998) and the U.S. Bureau of Indian Affairs in Sacramento, California (2001).

We excluded areas that do not contain one or more of the PCEs or were not essential for the conservation of the vernal pool species because: (1) The area is highly degraded and may not be restorable; (2) the area is small, highly fragmented, or isolated, and may provide little or no long-term conservation value; or (3) the area is excluded under section 4(b)(2) of the Act for military, economic or other reasons (*See* Exclusions Under section 4(b)(2)). The critical habitat units were further refined to remove lands determined not to be essential to the conservation of the vernal pool species through analysis conducted through the section 7 or section 10 process. The specific modifications are described in the Summary of Changes from the Revised Proposed Rule section of this rule.

Primary Constituent Elements

In accordance with section 3(5)(A)(i) of the Act and regulations at 50 CFR 424.12(b), in determining which areas to propose as critical habitat, we consider those physical and biological features essential to the conservation of the species and that may require special management considerations or protection. These include, but are not limited to, the following: (1) Space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and, generally; and (5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. Our regulations at 50 CFR 424.12(b) further direct that when considering the designation of critical habitat, we are to focus on the principal biological or physical constituent elements within the defined area that are essential to the conservation of the species, and we are to list known PCEs with the critical habitat description. Our regulations

describe known PCEs in terms that are more specific than the description of physical and biological features. Specifically, PCEs may include, but are not limited to, the following: roost sites, nesting grounds, spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, host species of plant pollinator, geological formation, vegetation type, tide, and specific soil types.

Based on our current knowledge of the life history and ecology of the 15 listed vernal pool species, the relationship of their essential life history functions to their habitat, and the ecological and hydrologic functions of vernal pool complexes, as summarized above in the Background section, we determined that all of the 15 vernal pool species share the following two PCEs. These are:

(1) Vernal pools, swales, and other ephemeral wetland features of appropriate sizes and depths that typically become inundated during winter rains and hold water for sufficient lengths of time necessary for the 15 species to complete their life cycle.

(2) The geographic, topographic, and edaphic features that support aggregations or systems of hydrologically interconnected pools, swales, and other ephemeral wetlands and depressions within a matrix of surrounding uplands that together form hydrologically and ecologically functional units called vernal pool complexes. These features contribute to the filling and drying of the vernal pool, maintain suitable periods of pool inundation, and maintain water quality and soil moisture to enable the 15 vernal pool species to carry out their lifecycles.

The first PCE provides the necessary soil moisture and aquatic environment required for seed germination, cyst hatching, growth, maturation, reproduction, and dispersal, and the appropriate periods of dry-down for seed and cyst dormancy. Both the wet and dry phases of the vernal pool help to reduce competition with strictly terrestrial or strictly aquatic plant or animal species. The wet phase provides the necessary cues for hatching, germination, and growth, while the drying phase allows the vernal pool plants to flower and produce seeds and the vernal pool crustaceans to mature and produce cysts. We conclude this element is essential to the conservation of the 15 vernal pool species because these species are ecologically dependent on seasonal fluctuations, such as absence or presence of water during specific times of the year, and duration of inundation and the rate of drying of their habitats. They cannot persist in perennial wetlands or wetlands that are inundated for the majority of the year, nor can they persist without periodic seasonal inundation.

The second PCE (the entire vernal pool complex, including the pools, swales, and associated uplands) is essential to maintain both the aquatic phase and the drying phase of the vernal pool habitat. Although the vernal pool species addressed in this rule do not occur in the strictly upland areas surrounding vernal pools, they are dependent on these upland areas to maintain the aquatic and drying phases of the vernal pool. The germination of vernal pool plants and hatching of cysts is dependent on the timing and length of inundation of the vernal pool habitat. The rate of vernal pool drying, during which vernal pool plants must flower and produce seeds, is also largely controlled by interactions between the vernal pool and the surrounding uplands (Hanes *et al.* 1990; Hanes and Stromberg 1998). The uplands also provide a source of nutrients and food sources for the 15 vernal pool species and provide habitat for pollinator species that may be specifically adapted to some of the plant species in this rule (Thorp 1998; Eriksen and Belk 1999). The uplands also provide habitat for avian species and other animals known to aide in the dispersal of the 15 vernal pool species (Zedler and Black 1992; Silveira 1998).

The first of these PCEs provides for space, physiological requirements, shelter, and reproduction sites for the 15 vernal pool species. Vernal pools and other ephemeral wetlands provide space during their wetted periods for individual and population growth and normal behavior of vernal pool species by providing still, freshwater habitat of appropriate depth, duration, temperature, and chemical characteristics for: (1) Juvenile and adult vernal pool crustaceans to hatch, swim, grow, reproduce and behave normally; (2) the aquatic stage of the seven Orcuttieae tribe plants to germinate and grow under water; and (3) saturating areas of ground to the extent and duration necessary to allow the four non-Orcuttiae plants to germinate and grow. Vernal pools and other ephemeral wetlands also provide soil space during both dry and wetted periods for the maintenance of dormant cyst and seed banks, which allow populations of vernal pool species to maintain themselves throughout the unpredictable and highly variable environmental conditions experienced by their nondormant life history stages.

Vernal pools and other ephemeral wetlands also provide various physiological requirements for both vernal pool plants and crustaceans. For crustaceans they provide water, oxygen, and food such as plankton, detritus, and (in the case of vernal pool tadpole shrimp) other small crustaceans. For vernal pool plants, they provide water and various nutrients from detritus that sinks to the bottom. They also provide oxygen for the aquatic leaves of Orcuttieae tribe plants.

By drying seasonally, ephemeral wetlands provide cover or shelter from many aquatic predators and competitors (*see* background section). Similarly, by undergoing seasonal inundation, these areas provide shelter for vernal pool plants from terrestrial plants which would otherwise outcompete them for space, light, water, or nutrients.

Finally, vernal pool crustaceans require wetted ephemeral wetlands in which to mate, and both vernal pool crustaceans and vernal pool plants deposit cysts or eggs in these wetland areas, which must then dry to allow hatching or germination. Wetted ephemeral wetlands may also tend to attract waterfowl, which act as important seed and cyst dispersers (Proctor 1965; Silveira 1998).

The second PCE, upland areas and vernal swales hydrologically associated with ephemeral wetlands, is essential for maintaining the seasonal cycle of ponding and drying in the ephemeral wetland areas. Upland areas are therefore essential for providing the same physical and biological factors as are provided by the ephemeral wetland areas. Additionally, they provide an important (and often primary) source of detritus, which is an important food source for vernal pool crustaceans and nutrient source for vernal pool plants. Upland and swale areas also provide habitat for waterfowl, amphibians, mammals, or insects, all of which are important for seed, pollen, or cyst dispersal. Certain upland and swale areas may also help disperse seeds and cysts more directly, and also provide for population growth by channeling flood waters from overflowing ephemeral wetland areas so that seeds, cysts, or adult individuals are washed from one such wetland to another.

We have used vernal pool complexes as the basis for determining populations of vernal pool crustaceans since the species were first proposed for listing. The final rule to list the four vernal pool crustaceans states that ''[t]he genetic characteristics of the three fairy shrimp and vernal pool tadpole shrimp, as well as ecological conditions, such as watershed contiguity, indicate that

populations of these animals are defined by pool complexes rather than by individual vernal pools'' (Fugate 1992, 1998; King 1996). Therefore, the most accurate indication of the distribution and abundance of the four vernal pool crustaceans is the number of inhabited vernal pool complexes. Individual vernal pools occupied by the four species listed herein are most appropriately referred to as ''subpopulations'' (59 FR 48136). Our use of vernal pool complexes to define populations of the four listed crustaceans was upheld by the U.S. District Court in post-listing challenge to the listing (*Building Industry Association of Superior California, et al.* v. *Babbit et al.,* CIV 95–0726 PLF). The July 25, 1997, court decision stated that the plaintiffs were on notice that the Service would consider vernal pool complexes as a basis for determining fairy shrimp populations. The court also concluded that the use of this methodology was neither arbitrary nor capricious. The Court of Appeals for the D.C. Circuit upheld the district court's decision, and the Supreme Court has declined to hear the case.

Each of the critical habitat units likely includes some areas that are unoccupied by the vernal pool crustaceans and vernal pool plants. ''Unoccupied'' is defined here as an area that contains no hatched vernal pool crustaceans or observed above-ground vernal pool plants, and that is unlikely to contain a viable cyst or seed bank. Determining the specific areas that the vernal pool crustaceans or vernal pool plants occupy is difficult because, depending on climatic factors and other natural variations in habitat conditions, the size of the localized area in which above-ground plants or hatched crustaceans appear may fluctuate dramatically from one year to another. In some years, individuals may be observed throughout a large area, and in other years they may be observed in a smaller area or not at all. Because it is logistically difficult to determine how extensive the cyst or seed bank is at any particular site, and because hatched vernal pool crustaceans or above-ground vernal pool plants may or may not be present in all vernal pools within a site every year, we cannot quantify in any meaningful way what proportion of each critical habitat unit may actually be occupied by the vernal pool crustaceans or vernal pool plants. Therefore, areas of unoccupied habitat are probably interspersed with areas of occupied habitat in each unit. The inclusion of unoccupied habitat in our critical habitat units reflects the dynamic nature of the habitat and the life history characteristics of the vernal pool crustaceans and vernal pool plants. Unoccupied areas provide areas into which populations might expand, provide connectivity or linkage between groups of organisms within a unit, and support populations of pollinators and seed dispersal organisms. Both occupied and unoccupied areas that are designated as critical habitat are essential to the conservation of the species.

All of the above described PCEs do not have to occur simultaneously within a unit for the unit to constitute critical habitat for any of the 15 vernal pool species. We determined the PCEs of critical habitat for the 15 species based on studies on their habitat and population biology, including but not limited to Kalin-Arroyo 1973; Ellias 1986; Corbin and Schoolcraft 1989; Jokerst 1989; Eng *et al.* 1990; Alexander and Schlising 1997; Helm 1998; Witham 1998; Eriksen and Belk 1999; Grosberg 2002. Additional information on species-specific PCEs are outlined below in Descriptions of Critical Habitat Units for each species.

Conservation Criteria Used to Identify Critical Habitat

Based on the best scientific information available, all areas identified as critical habitat for the 15 vernal pool species addressed by this rule are within the historical and current ranges of each of the species and contain the two PCEs identified above. Rather than designate every area containing PCEs, however, we designated only those areas which available evidence clearly demonstrated were essential to the conservation of each species. Areas for which the evidence available at this time was less certain were not included in this designation, although we believe these areas to be important to the species and may include them in future recovery plans. Areas essential to the conservation of the species are those that are necessary to advance at least one of the following conservation criteria:

(1) The conservation of areas representative of the geographic distribution of the species. Species that are protected across their ranges have lower chances of extinction (Soule and Simberloff 1986; Murphy *et al.* 1990; Primack 1993; Given 1994; Hunter 1996; Pavlik 1996; Noss *et al.* 1999; Grosberg 2002). Maintenance of representative occurrences of the species throughout its geographic range helps ensure the conservation of regional adaptive differences and makes the species less susceptible to environmental variation or negative impacts associated with human disturbances or natural catastrophic events across the species' entire range at any one time (Primack 1993; New 1995; Hunter 1996; Helm 1998; Redford and Richter 1999; Rossum *et al.* 2001; Grosberg 2002). Additionally, the conservation of the geographic distribution of the species is one of the physical and biological features we are required to consider under our regulations (50 CFR 424.13(b)). Accordingly, we considered the number of occupied areas in each vernal pool region (Sawyer and Keeler-Wolf 1995), and determined roughly the extent to which each occupied area would likely be necessary for the conservation of the species in the region or as a whole.

(2) The conservation of areas representative of the ecological distribution of the species. Each of the 15 vernal species is associated with various combinations of soil types, vernal pool chemistry, geomorphic surfaces (landforms), and vegetation community associations. Maintaining the full range of varying habitat types and characteristics for a species is essential because it would include the full extent of the physical and environmental conditions necessary for the species (Zedler and Ebert 1979; Ikeda and Schlising 1990; Fugate 1992; Gonzales *et al.*1996; Fugate 1998; Platenkamp 1998; Bainbridge 2002; Noss *et al.* 2002a). Vernal pool species are extremely adapted to the physical and chemical characteristics of the habitat in which they occur. Additionally, the conservation of the ecological distribution of the species is one of the physical and biological features we are required to consider under our regulations 50 CFR 424.13(b), and was also strongly endorsed by at least one peer reviewer (*see* Peer Review section). Accordingly, we considered the extent to which habitat types occupied by the species could be expected to be conserved in light of the number of occupied areas and the threats involved.

(3) The conservation of areas necessary to allow movement of cysts, pollen, and seeds between areas representative of the geographic and ecological distribution of the species. As a result of dispersal events within and between vernal pool complexes, and environmental conditions that may prevent the emergence of dormant cysts and seeds for up to several decades, the presence of vernal pool species is dynamic in both space and time (Eriksen and Belk 1999; Noss *et al.* 2002a). We therefore determined that essential habitat for the vernal pool

species must provide for movement within and between vernal pool complexes to provide for the varying nature and expression of vernal pool species,and also allow for gene flow and dispersal and habitat availability that accommodate natural processes of local extirpation and colonization over time (Stacey and Taper 1992; Falk *et al.* 1996; Davies *et al.* 1997; Husband and Barrett 1998; Holt and Keitt 2000; Keymer *et al.* 2000; Donaldson *et al.* 2002).

(4) In cases where more occupied areas were present than were needed for the conservation of the geographic or ecological distribution of the species, we gave priority to areas which already possessed a measure of protection or which possessed the largest unfragmented vernal pool complexes. Other criteria being equal, such areas are likely to contribute more to the conservation of the species because threats posed by habitat fragmentation are more easily minimized within them. Small, isolated habitat populations are more likely to be extirpated by direct or indirect natural or human impacts (Fahrig 1997; Noss and Csuti 1997; Debinski and Holt 2000; Grosberg 2002; Noss *et al.* 2002a), and are less likely to maintain the hydrological processes of pooling and drying on which the vernal pool species depend.

Based on these criteria, we determined that all currently known extant occurrences of the 11 vernal pool plants and 2 of the 4 vernal pool crustaceans (Conservancy fairy shrimp and longhorn fairy shrimp) are essential to the conservation of the species, due to their limited geographic and ecological distributions (criteria 1 and 2), low overall number of populations (criterion 1), and the seriousness of the threats posed to remaining populations, including fragmentation of habitat. For the other two vernal pool crustaceans (vernal pool fairy shrimp and vernal pool tadpole shrimp), we were able to meet the criteria listed above without designating all occupied areas.

Special Management Considerations

In designating critical habitat, we also have considered how this designation highlights habitat that needs special management considerations or protection. For example, we have many regional HCPs under development, and this designation will be useful in helping applicants determine what vernal pool habitat areas should be highest priority for special management or protection, and where there may be more flexibility in conservation options. This designation will guide them and us in ensuring that all local habitat conservation planning efforts are consistent with conservation objectives for these species.

Once a vernal pool habitat has been protected from direct filling, it is still necessary to ensure that the habitat is not rendered unsuitable for vernal pool species because of factors such as altered hydrology, contamination, nonnative species invasions, or other incompatible land uses. Even the best-designed vernal pool preserve may still be susceptible to alterations that render it unsuitable for vernal pool species. Many of the factors that cause the decline and localized extirpation of vernal pool species can be controlled through special management actions. Examples of special management actions that may be necessary to prevent further declines and loss of populations of species addressed in this rule include the following:

(1) Actions to prevent or reduce competition of vernal pool plants with invasive species. Many of the species addressed in this rule are threatened by invasion of nonnative species (CNDDB 2001). Special management actions can be taken to reduce the negative effects of such invasions. For example, grazing can be effectively used to control a variety of upland exotic plants. However, the timing and intensity of grazing is critical to its success as a management tool, and these factors should be closely monitored. Alternatively, inappropriate grazing can also pose a threat to many of the vernal pool plant species (CNDDB 2001). Prescribed burning is another management tool that may be effective in controlling nonnative plant species (Pollack and Kan 1998).

Fire must be appropriately timed, and fire frequency is important. The potential for alteration of nutrient cycling must be also considered. Other management techniques for control of invasive species include mowing, hand removal, and selective herbicide applications. Any technique employed must be carefully controlled and monitored to ensure that it does not negatively affect the vernal pool species.

(2) Actions to restore vernal pool hydrology. Alteration of natural hydrology threatens many of the species addressed in this rule (CNDDB 2001). In many cases other threats, such as the invasion of nonnative species or contamination, are facilitated by alterations of natural vernal pool hydrology. Special management actions, such as the removal of dams or other structures that artificially increase the length of vernal pool inundation, the removal of ditches that artificially drain vernal pools, or the construction of berms or reconstruction of culverts to prevent water from flowing artificially into vernal pools from adjacent areas, can be taken to restore natural vernal pool hydrology. Modification of grazing regimes may also restore natural vernal pool hydrology (Barry 1998). Monitoring of vernal pool hydrology is important to ensure that restoration actions are successful.

(3) Actions to reduce human degradation of vernal pools. Special management actions such as fencing, trail building, and posting signs can help to reduce human activities that threaten vernal pool species. These actions may reduce the damage resulting from off-road vehicle use, dumping, and vandalism that threatens many of the species addressed in this rule.

(4) Actions to restore severely degraded habitats. Active restoration of highly degraded vernal habitats may be necessary in some areas. Such restoration may involve earth-moving activities designed to restore historic pool and swale topography and to reestablish natural vernal pool hydrology (Ferren and Hubbard 1998; Black and Zedler 1998). These types of actions are extremely complex, and require diligent planning and monitoring to ensure their success. Active restoration is only recommended for seriously degraded habitats that otherwise would not maintain natural vernal pool ecosystem processes.

Critical Habitat Designation

The approximate area of critical habitat by county and land ownership is shown in Tables 1 and 2. Because many of the units of overlap due to species occurrences within the same area, the total of all critical habitat designated is much less than the sum of critical habitat areas for each species. Lands designated are under private, State, and Federal ownership and divided into 125 Critical Habitat Units. The tables provide separate columns for privately owned land subject to conservation easements or agreements and other privately owned lands. The amount of land area identified as critical habitat for vernal pool tadpole shrimp unit 15, Butte County meadowfoam unit 3, San Joaquin Valley Orcutt grass unit 2, and Contra Costa goldfields unit 3, differ from those identified in the tables due to changes in the GIS coverages used to calculate those areas. The total amount of critical habitat for all species is not affected.

Table 1. Approximate areas of critical habitat for the vernal pool crustaceans and plants in California and Oregon.

TABLE 1.—APPROXIMATE AREAS OF CRITICAL HABITAT FOR THE VERNAL POOL CRUSTACEANS AND PLANTS IN CALIFORNIA AND OREGON

	Federal lands			State/County lands			Private lands			Total lands		
	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)
Conservancy Fairy Shrimp:												
Unit 1	0	0	0	0	0	0	20,546	16,182	−4,346	20,546	16,182	−4,364
	(0)	(0)	(0)	(0)	(0)	(0)	(50,769)	(39,986)	(−10,783)	(50,769)	(39,986)	(−10,783)
Unit 2	5,187	1,307	−3,880	0	0	0	531	1	−530	5,718	1,308	−4,410
	(12,816)	(3,229)	(−9,587)	(0)	(0)	(0)	(1,313)	(4)	(−1,309)	(14,129)	(3,233)	(−10,896)
Unit 3	241	0	−241	329	161	−168	9,356	9,475	119	9,927	9,637	−290
	(596)	(1)	(−595)	(814)	(399)	(−415)	(23,119)	(23,413)	(294)	(24,529)	(23,812)	(−717)
Unit 4	0	0	0	0	0	0	603	448	−155	603	448	−155
	(0)	(0)	(0)	(0)	(0)	(0)	(1,490)	(1,106)	(−384)	(1,490)	(1,106)	(−384)
Unit 5	299	299	0	0	0	0	3	3	0	302	302	0
	(739)	(739)	(0)	(0)	(0)	(0)	(7)	(7)	(0)	(746)	(746)	(0)
Unit 6	427	3	−424	11	0	−11	63,312	53,782	−9,530	63,750	53,785	−9,965
	(1,056)	(8)	(−1,048)	(26)	(0)	(−26)	(156,443)	(132,894)	(−23,549)	(157,525)	(132,902)	(−24,623)
Unit 7 A–F	12,765	8,470	−4,295	3,096	0	−3,095	30,282	1,356	−28,926	46,142	9,827	−36,316
	(31,542)	(20,929)	(−10,614)	(7,649)	(1)	−7,648	(74,825)	(3,351)	(−71,474)	(114,016)	(24,281)	(−89,735)
Unit 8	18,042	18,042	0	0	0	0	789	789	0	18,831	18,831	0
	(44,581)	(44,581)	(0)	(0)	(0)	(0)	(1,950)	(1,950)	(0)	(46,531)	(46,531)	(0)
Species total	36,961	20,784	−16,177	3,435	162	−3,274	125,423	82,037	−43,386	165,820	102,983	−62,837
	(91,330)	(51,357)	(−39,973)	(8,489)	(400)	(−8,089)	(309,916)	(202,711)	(−107,205)	(409,735)	(254,467)	(−155,268)
Longhorn Fairy Shrimp:												
Unit 1 A–B	0	0	0	0	0	0	321	320	−1	321	320	−1
	(0)	(0)	(0)	(0)	(0)	(0)	(794)	(791)	(-3)	(794)	(791)	(-3)
Unit 2	9,413	2,604	−6,808	3,096	0	−3,096	17,308	525	−16,784	29,817	3,130	−26,688
	(23,258)	(6,435)	(−16,823)	(7,651)	(1)	(−7,650)	(42,768)	(1,297)	(−41,472)	(73,677)	(7,733)	(−65,944)
Unit 3	6,293	6,293	0	94	95	0	4,079	4,079	0	10,466	10,466	0
	(15,549)	(15,549)	(0)	(233)	(234)	(1)	(10,080)	(10,079)	(−1)	(25,862)	(25,862)	(0)
Species total	15,705	7,421	−8,284	3,191	95	−3,096	21,709	4,924	−16,785	40,605	12,440	−28,165
	(38,807)	(18,337)	(−20,470)	(7,884)	(235)	−7,649	(53,642)	(12,167)	(−41,475)	(100,333)	(30,739)	(−69,594)
Vernal Pool Fairy Shrimp:												
Unit 1 A–G	0	0	0	0	0	0	862	862	0	862	862	0
	(0)	(0)	(0)	(0)	(0)	(0)	(2,130)	(2,130)	(0)	(2,130)	(2,130)	(0)
Unit 2 A–E	0	0	0	0	0	0	911	911	0	931	931	0
	(0)	(0)	(0)	(0)	(0)	(0)	(2,251)	(2,251)	(0)	(2,251)	(2,251)	(0)
Unit 3 A–G	0	0	0	0	0	0	931	931	(0)	931	931	0
	(0)	(0)	(0)	(0)	(0)	(0)	(2,301)	(2,301	(0)	(2,301)	(2,301)	(0)
Unit 4 A–B	175	175	0	0	0	0	186	186	0	361	361	0
	(432)	(432)	(0)	(0)	(0)	(0)	(460)	(460)	(0)	(892)	(892)	(0)
Unit 5	17	17	0	0	0	0	1,832	1,468	−364	1,849	1,485	−364
	(42)	(41)	(−1)	(0)	(0)	(0)	(4,527)	(3,627)	(−900)	(4,569)	(3,668)	(−901)
Unit 6	0	0	0	175	174	−1	18,386	15,863	−2,523	18,562	16,037	−2,524
	(0)	(0)	(0)	(433)	(431)	(−2)	(45,432)	(39,198)	(−6,234)	(45,865)	(39,629)	(−6,236)
Unit 7	0	0	0	0	0	0	23,883	19,438	−4,445	23,883	19,438	−4,445
	(0)	(0)	(0)	(0)	(0)	(0)	(59,015)	(48,030)	(−10,985)	(59,015)	(48,030)	(−10,985)
Unit 8	0	0	0	0	0	0	5,760	5,130	−630	5,760	5,130	−630
	(0)	(0)	(0)	(0)	(0)	(0)	(14,233)	(12,676)	(−1,557)	(14,233)	(12,676)	(−1,557)
Unit 9	76	0	−76	0	0	0	1,380	1,131	−250	1,456	1,131	−326
	(187)	(0)	(−187)	(0)	(0)	(0)	(3,411)	(2,794)	(−617)	(3,598)	(2,794)	(−804)
Unit 10	5,187	1,307	−3,880	0	0	0	531	1	−530	5,718	1,308	−4,410
	(12,816)	(3,230)	(−9,586)	(0)	(0)	(0)	(1,313)	(3)	(−1,310)	(14,129)	(3,233)	(−10,896)
Unit 11	2,035	0	2,035	0	0	0	818	536	−282	2,853	536	−2,317
	(5,028)	(0)	(−5,028)	(0)	(0)	(0)	(2,021)	(1,324)	(−697)	(7,049)	(1,324)	(−5,725)
Unit 12	0	0	0	0	0	0	19,387	13,043	−6,344	−19,387	13,043	−6,344
	(0)	(0)	(0)	(0)	(0)	(0)	(47,905)	(32,230)	(−15,675)	47,905)	(32,230)	(−15,675)
Unit 13	6	0	−6	0	0	0	14,859	9,851	−5,009	−14,866	9,851	−5,015
	(16)	(0)	(−16)	(0)	(0)	(0)	(36,717)	(24,341)	(−12,376)	(36,733)	(24,341)	(−12,392)
Unit 14	0	0	0	630	0	−630	25,970	18,856	−7,114	26,600	18,856	−7,744
	(0)	(0)	(0)	(1,557)	(0)	(−1,557)	(64,171)	(46,593)	(−17,578)	(65,728)	(46,593)	(−19,135)
Unit 15	0	0	0	60	60	0	1,563	496	−1,067	1,624	556	−1,067
	(0)	(0)	(0)	(149)	(149)	(0)	(3,863)	(1,226)	(−2,637)	(4,012)	(1,375)	(−2,637)
Unit 16	1,015	12	−1,002	1,038	488	−550	32,858	25,754	−7,104	34,910	26,254	−8,656
	(2,507)	(31)	(−2,476)	(2,564)	(1,205)	(−1,359)	(81,190)	(63,637)	(−17,553)	(86,261)	(64,873)	(−21,388)
Unit 17	0	0	0	170	126	−44	486	503	17	656	629	−27
	(0)	(0)	(0)	(420)	(311)	(−109)	(1,201)	(1,244)	(43)	(1,621)	(1,555)	(−66)
Unit 18	0	0	0	0	0	0	7,105	5,805	−1,301	7,105	5,805	−1,301
	(0)	(0)	(0)	(0)	(0)	(0)	(17,557)	(14,343)	(−3,214)	(17,557)	(14,343)	(−3,214)
Unit 19 A–C	0	0	0	64	44	−20	3,292	3,154	−138	3,356	3,198	−158
	(0)	(0)	(0)	(157)	(108)	(−49)	(8,135)	(7,795)	(−340)	(8,292)	(7,903)	(−389)
Unit 20	299	299	0	0	0	0	3	3	0	302	302	0
	(739)	(739)	(0)	(0)	(0)	(0)	(7)	(7)	(0)	(746)	(746)	(0)
Unit 21	7	7	0	25	17	−8	25,285	19,644	−5,641	25,317	19,668	−5,649
	(17)	(17)	(0)	(61)	(41)	(−20)	(62,479)	(48,590)	(−13,889)	(62,557)	(48,649)	(−13,908)
Unit 22	3	3	0	11	0	−11	51,713	45,104	−6,609	−51,727	45,107	−6,620
	(8)	(8)	(0)	(26)	(0)	(−26)	(127,782)	(111,452)	(−16,330)	(127,782)	(111,460)	(−16,356)
Unit 23 A–G	13,943	8,470	−5,472	3,096	1	−3,095	38,872	4,944	−33,928	−55,911	13,415	−42,495
	(34,452)	(20,930)	(−13,522)	(7,649)	(2)	(−7,647)	(96,052)	(12,216)	(−83,836)	(138,153)	(33,148)	(−105,005)
Unit 24 A–B	0	0	0	0	0	0	17,231	16,606	−625	17,232	16,606	−626
	(0)	(0)	(0)	(1)	(0)	(−1)	(42,578)	(41,032)	(−1,546)	(42,579)	(41,032)	(−1,547)
Unit 25	65	65	0	0	0	0	929	929	0	994	994	0
	(161)	(161)	(0)	(0)	(0)	(0)	(2,295)	(2,295)	(0)	(2,456)	(2,456)	(0)
Unit 26 A–C	0	0	0	348	86	−263	2,845	2,981	136	3,193	3,067	−126
	(0)	(0)	(0)	(861)	(212)	(−649)	(7,030)	(7,367)	(337)	(7,891)	(7,579)	(−312)
Unit 27 A–B	2,742	3,025	283	490	1,297	808	4,610	2,803	−1,807	7,842	7,126	−716
	(6,776)	(7,475)	(699)	(1,210)	(3,206)	(1,996)	(11,391)	(6,923)	(−4,468)	(19,377)	(17,604)	(−1,773)
Unit 28	1,581	1,581	0	2	2	0	46,542	46,542	0	48,125	48,125	0

TABLE 1.—APPROXIMATE AREAS OF CRITICAL HABITAT FOR THE VERNAL POOL CRUSTACEANS AND PLANTS IN CALIFORNIA AND OREGON—Continued

	Federal lands			State/County lands			Private lands			Total lands		
	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)
	(3,906)	(3,906)	(0)	(5)	(5)	(0)	(115,004)	(115,004)	(0)	(118,915)	(118,915)	(0)
Unit 29 A–C	20,586	588	−19,998	0	118	118	20,468	20,268	−200	41,054	20,974	−20,081
	(50,868)	(1,452)	(−49,416)	(0)	(291)	(291)	(50,576)	(50,081)	(−495)	(101,444)	(51,824)	(−49,620)
Unit 30	6,293	6,293	0	94	95	0	4,079	4,079	0	10,466	10,466	0
	(15,549)	(15,549)	(0)	(233)	(234)	(1)	(10,080)	(10,079)	(−1)	(25,862)	(25,862)	(0)
Unit 31	2,236	2,237	0	0	0	0	6,163	6,163	0	8,399	8,399	0
	(5,526)	(5,527)	(1)	(0)	(0)	(0)	(15,228)	(15,228)	(0)	(20,754)	(20,755)	(1)
Unit 32	18,042	18,042	0	0	0	0	790	789	0	18,831	18,831	0
	(44,580)	(44,581)	(1)	(0)	(0)	(0)	(1,951)	(1,951)	(0)	(46,531)	(46,531)	(0)
Unit 33 A–C	0	0	0	0	0	0	2,319	0	−2,319	2,319	0	−2,319
	(0)	(0)	(0)	(0)	(0)	(0)	(5,729)	(0)	(−5,729)	(5,729)	(0)	(−5,729)
Unit 34	0	0	0	761	0	−761	958	0	−958	1,718	0	−1,718
	(0)	(0)	(0)	(1,880)	(0)	(−1,880)	(2,366)	(0)	(−2,366)	(4,246)	(0)	(−4,246)
Unit 35	0	0	0	0	0	0	97	0	−97	97	0	−97
	(0)	(0)	(0)	(0)	(0)	(0)	(239)	(0)	(−239)	(239)	(0)	(−239)
Species total	74,307	42,121	−32,186	6,963	2,507	−4,456	388,509	301,674	−86,834	469,779	344,004	−125,775
	(183,960)	(104,427)	(−79,532)	(17,206)	6,194)	(−11,012)	(948,992)	(734,480)	(−214,513	(1,150,124)	(839,460)	(−310,664)
Vernal Pool Tadpole Shrimp:												
Unit 1	17	17	0	0	0	0	1,832	1,417	−415	1,849	1,434	−415
	(42)	(41)	(−1)	(0)	(0)	(0)	(4,527)	(3,502)	(−1,025)	(4,569)	(3,543)	(−1,026)
Unit 2	6,226	6,000	−226	437	287	−151	13,783	13,867	84	20,446	20,154	−293
	(15,383)	(14,826)	(−557)	(1,081)	(709)	(−372)	(34,058)	(34,265)	(207)	(50,522)	(49,799)	(−723)
Unit 3	0	0	0	0	0	0	23,883	19,438	−4,445	23,883	19,438	−4,445
	(0)	(0)	(0)	(0)	(0)	(0)	(59,015)	(48,030)	(−10,985)	(59,015)	(48,030)	(−10,985)
Unit 4	127	36	−91	0	0	0	15,848	13,922	−1,926	15,975	13,958	−2,017
	(313)	(89)	(−224)	(0)	(0)	(0)	(39,161)	(34,401)	(−4,760)	(39,474)	(34,490)	(−4,984)
Unit 5	5,187	1,307	−3,880	0	0	0	531	1	−530	5,718	1,308	−4,410
	(12,816)	(3,230)	(−9,586)	(0)	(0)	(0)	(1,313)	(3)	(−1,310)	(14,129)	(3,233)	(−10,896)
Unit 6	0	0	0	0	0	0	526	397	−129	526	397	−129
	(0)	(0)	(0)	(0)	(0)	(0)	(1,299)	(980)	(−319)	(1,299)	(980)	(−319)
Unit 7	2,035	0	−2,035	0	0	0	818	536	−282	2,853	536	−2,317
	(5,028)	(0)	(−5,028)	(0)	(0)	(0)	(2,021)	(1,324)	(−697)	(7,049)	(1,324)	(−5,725)
Unit 8	6	0	−6	0	0	0	14,859	9,851	−5,009	14,866	9,851	−5,015
	(16)	(0)	(−16)	(0)	(0)	(0)	(36,717)	(24,341)	(−12,376)	(36,733)	(24,341)	(−12,392)
Unit 9	0	0	0	630	0	−630	28,433	18,856	−9,577	29,063	18,856	−10,207
	(0)	(0)	(0)	(1,557)	(0)	(−1,557)	(70,256)	(46,593)	(−23,663)	(71,813)	(46,593)	(−25,220)
Unit 10	130	125	−4	0	0	0	62	53	−9	192	178	−14
	(321)	(310)	(−11)	(0)	(0)	(0)	(153)	(130)	(−23)	(474)	(440)	(−34)
Unit 11	760	12	−748	1,038	488	−550	32,812	26,195	−6,617	34,610	26,695	−7,915
	(1,879)	(31)	(−1,848)	(2,565)	(1,205)	(−1,360)	(81,077)	(64,727)	(−16,350)	(85,521)	(65,963)	(−19,558)
Unit 12	0	0	0	0	0	0	603	448	−155	603	448	−155
	(0)	(0)	(0)	(0)	(0)	(0)	(1,490)	(1,106)	(−384	(1,490)	(1,106)	(−384
Unit 13	0	0	0	0	0	0	9,408	6,606	−2,802	9,408	6,606	−2,802
	(0)	(0)	(0)	(0)	(0)	(0)	(23,246)	(16,323)	(−6,923)	(23,246)	(16,323)	(−6,923)
Unit 14	10	287	277	0	0	0	448	38	−410	458	325	−133
	(24)	(709)	(685)	(0)	(0)	(0)	(1,108)	(93)	(−1,015)	(1,132)	(802)	(−133)
Unit 15	3	0	−3	11	0	−11	71,062	24,840	−46,222	71,076	24,840	−46,236
	(8)	(0)	(−8)	(26)	(0)	(−26)	(175,592)	(61,379)	(−114,213)	(175,626)	(61,379)	(−114,247)
Unit 16	13,943	15,886	1,943	3,096	0	−3,095	38,872	4,944	−33,928	55,911	20,830	−35,080
	(34,452)	(39,253)	(4,801)	(7,649)	(1)	(−7,648	(96,052)	(12,216)	(−83,836)	(138,153)	(51,470)	(−86,683)
Unit 17	85	77	−8	174	170	−4	482	483	1	740	729	−11
	(209)	(190)	(−19)	(430)	(419)	(−11)	(1,190)	(1,193)	(3)	(1,829)	(1,802)	(−27)
Unit 18	0	0	0	348	86	−263	2,845	2,981	136	3,193	3,067	−126
	(0)	(0)	(0)	(861)	(212)	(−649)	(7,030)	(7,367)	(337)	(7,891)	(7,579)	(−312)
Species total	28,612	23,830	−4,782	5,734	1,030	−4,704	266,162	151,876	−114,286	300,508	176,736	−123,772
	(82,942)	(70,678)	(−12,264)	(15,044)	(3,119)	(−11,925)	(662,872)	(385,707)	(−277,164)	(760,858)	(459,505)	(−301,353)
Butte County Meadowfoam:												
Unit 1	0	0	0	0	0	0	6,105	5,608	−497	6,105	5,608	−497
	(0)	(0)	(0)	(0)	(0)	(0)	(15,086)	(13,858)	(−1,228)	(15,086)	(13,858)	(−1,228)
Unit 2	0	0	0	0	0	0	3,508	2,413	−1,094	3,508	2,413	−1,094
	(0)	(0)	(0)	(0)	(0)	(0)	(8,667)	(5,964)	(−2,704)	(8,667)	(5,964)	(−2,704)
Unit 3	9	0	−9	0	0	0	1,687	414	−1,274	1,696	414	−1,283
	(22)	(0)	(−22)	(0)	(0)	(0)	(4,169)	(1,022)	(−3,147)	(4,191)	(1,022)	(−3,169)
Unit 4	0	0	0	0	0	0	5,011	4,230	−781	5,011	4,230	−781
	(0)	(0)	(0)	(0)	(0)	(0)	(12,382)	(10,451)	(−1,931)	(12,382)	(10,451)	(−1,931)
Species total	9	0	−9	0	0	0	16,311	12,665	−3,646	16,320	12,665	−3,655
	(22)	(0)	(−22)	(0)	(0)	(0)	(40,304)	(31,294)	(−9,010)	(40,326)	(31,294)	(−9,032)
Contra Costa Goldfields:												
Unit 1	0	0	0	0	0	0	1,067	1,067	0	1,067	1,067	0
	(0)	(0)	(0)	(0)	(0)	(0)	(2,637)	(2,637)	(0)	(2,637)	(2,637)	(0)
Unit 2	0	0	0	0	0	0	411	411	0	411	411	0
	(0)	(0)	(0)	(0)	(0)	(0)	(1,016)	(1,016)	(0)	(1,016)	(1,016)	(0)
Unit 3	0	0	0	0	0	0	240	275	34	240	275	34
	(0)	(0)	(0)	(0)	(0)	(0)	(594)	(678)	(84)	(594)	(678)	(84)
Unit 4	1,954	0	−1,954	122	0	−122	5,809	4,304	−1,505	7,885	4,305	−3,581
	(4,828)	(0)	(−4,828)	(301)	(0)	(−301)	(14,355)	(10,636)	(−3,719)	(19,484)	(10,637)	(−8,847)
Unit 5 A–B	0	0	0	0	0	0	410	353	−57	410	353	−57
	(0)	(0)	(0)	(0)	(0)	(0)	(1,014)	(872)	(−142)	(1,014)	(872)	(−142)
Unit 6	0	0	0	0	0	0	242	162	−81	242	162	−81
	(0)	(0)	(0)	(0)	(0)	(0)	(599)	(399)	(−200)	(599)	(399)	(−200)
Unit 7	0	0	0	291	40	−251	1,088	1,289	201	1,378	1,329	−49
	(0)	(0)	(0)	(718)	(99)	(−619)	(2,688)	(3,185)	(497)	(3,406)	(3,284)	(−122)

TABLE 1.—APPROXIMATE AREAS OF CRITICAL HABITAT FOR THE VERNAL POOL CRUSTACEANS AND PLANTS IN CALIFORNIA AND OREGON—Continued

	Federal lands			State/County lands			Private lands			Total lands		
	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)
Unit 8	448	287	−162	0	0	0	10	38	28	458	325	−133
	(1,108)	(709)	(−400)	(0)	(0)	(0)	(24)	(93)	(69)	(1,132)	(802)	(−331)
Unit 9	3,370	2,782	−588	2	0	−2	0	0	0	3,372	2,782	−589
	(8,326)	(6,874)	(−1,452)	(4)	(0)	(−4)	(1)	(1)	(0)	(8,331)	(6,874)	(−1,457)
Species total	5,772	3,069	−2,703	414	40	−374	9,279	7,899	−1,380	15,465	11,008	−4,457
	(14,262)	(7,582)	(−6,680)	(1,023)	(99)	(−924)	(22,928)	(19,517)	(−3,411)	(38,213)	(27,199)	(−11,014)
Hoover's Spurge:												
Unit 1	0	0	0	0	0	0	11,673	10,159	−1,514	11,674	10,159	−1,515
	(0)	(0)	(0)	(1)	(0)	(−1)	(28,844)	(25,102)	(−3,742)	(28,845)	(25,102)	(−3,743)
Unit 2	0	0	0	0	0	0	979	979	0	979	979	0
	(0)	(0)	(0)	(0)	(0)	(0)	(2,418)	(2,418)	(0)	(2,418)	(2,418)	(0)
Unit 3	5,187	1,307	−3,880	0	0	0	531	1	−530	5,718	1,308	−4,410
	(12,816)	(3,230)	(−9,586)	(0)	(0)	(0)	(1,313)	(3)	(−1,310)	(14,129)	(3,233)	(−10,896)
Unit 4	0	0	0	0	0	0	16,839	15,799	−1,041	16,839	15,799	−1,041
	(0)	(0)	(0)	(0)	(0)	(0)	(41,609)	(39,038)	(−2,571)	(41,609)	(39,038)	(−2,571)
Unit 5	0	0	0	24	17	−7	19,826	14,353	−5,473	19,850	14,370	−5,480
	(0)	(0)	(0)	(60)	(41)	(−19)	(48,989)	(35,466)	(−13,523)	(49,049)	(35,508)	(−13,541)
Unit 6	3,232	5,865	2,633	0	0	0	11,078	831	−10,247	14,310	6,696	−7,614
	(7,985)	(14,493)	(6,508)	(0)	(0)	(0)	(27,374)	(2,054)	(−25,320)	(35,359)	(16,547)	(−18,812)
Unit 7A –D	13	14	0	355	88	−267	12,007	9,424	−2,583	−12,375	9,526	−2,849
	(33)	(33)	(0)	(877)	(218)	(−659)	(29,668)	(23,286)	(−6,382)	(30,578)	(23,537)	(−7,041)
Species total	8,432	7,186	−1,246	380	105	−275	72,933	51,545	−21,388	81,744	58,836	322,908
	(20,834)	(17,756)	(−3,078)	(938)	(259)	(−679)	(180,215)	(127,368)	(−52,847)	(201,987)	(145,383)	(−56,604)
Fleshy Owl's-Clover:												
Unit 1	0	0	0	0	0	0	1,051	980	−71	1,051	980	−71
	(0)	(0)	(0)	(0)	(0)	(0)	(2,598)	(2,422)	(−176)	(2,598)	(2,422)	(−176)
Unit 2	0	0	0	0	0	0	14,131	13,640	−490	14,131	13,640	−490
	(0)	(0)	(0)	(0)	(0)	(0)	(34,917)	(33,705)	(−1,212)	(34,917)	(33,705)	(−1,212)
Unit 3 A–B	427	3	−424	11	0	−11	62,915	55,839	−7,076	63,353	55,842	−7,510
	(1,056)	(8)	(−1,048)	(26)	(0)	(−26)	(155,460)	(137,977)	(−17,483)	(156,542)	(137,985)	(−18,557)
Unit 4	5	5	0	56	23	−33	33,009	30,710	−2,299	33,071	30,738	−2,332
	(13)	(13)	(0)	(139)	(56)	(−83)	(81,565)	(75,884)	(−5,681)	(81,717)	(75,954)	(−5,763)
Unit 5	0	0	0	0	0	0	11,888	10,686	−1,202	11,888	10,686	−1,201
	(0)	(0)	(0)	(1)	(0)	(−1)	(29,374)	(26,406)	(−2,968)	(29,375)	(26,406)	(−2,969)
Unit 6 A–B	150	142	−8	174	170	−4	1,399	1,412	12	1,723	1,723	0
	(371)	(350)	(−21)	(429)	(419)	(−10)	(3,458)	(3,488)	(30)	(4,258)	(4,258)	(0)
Species total	583	150	−433	241	193	−48	124,393	113,268	−11,125	125,217	113,611	−11,606
	(1,440)	(371)	(−1,069)	(595)	(476)	(−119)	(307,372)	(279,882)	(−27,490)	309,407	280,729	(−28,678)
Colusa Grass:												
Unit 1	130	125	−5	0	0	0	62	53	−9	192	178	−14
	(322)	(310)	(−12)	(0)	(0)	(0)	(152)	(130)	(−22)	(474)	(440)	(−34)
Unit 2	94	0	−94	258	161	−96	6,801	6,878	77	7,153	7,039	−114
	(233)	(0)	(−233)	(637)	(399)	(−238)	(16,805)	(16,995)	(190)	(17,675)	(17,394)	(−281)
Unit 3	0	0	0	0	0	0	16,475	15,544	−931	16,475	15,544	−931
	(0)	(0)	(0)	(0)	(0)	(0)	(40,709)	(38,408)	(−2,301)	(40,709)	(38,408)	(−2,301)
Unit 4	0	0	0	0	0	0	35,134	28,657	−6,477	35,134	28,657	−6,477
	(0)	(0)	(0)	(0)	(0)	(0)	(86,814)	(70,810)	(−16,004)	(86,814)	(70,810)	(−16,004)
Unit 5	0	0	0	25	17	−8	19,825	14,353	−5,472	19,850	14,370	−5,480
	(0)	(0)	(0)	(61)	(41)	(−20)	(48,988)	(35,466)	(−13,522)	(49,049)	(35,508)	(−13,541)
Unit 6	427	3	−424	11	0	11	45,204	37,685	−7,519	45,642	37,688	−7,954
	(1,055)	(8)	(−1,047)	(26)	(0)	(−26)	(111,698)	(93,118)	(−18,580)	(112,779)	(93,125)	(−19,654)
Unit 7 A–B	1,422	2,927	1,505	0	0	0	6,741	2,562	−4,179	8,163	5,489	−2,674
	(3,514)	(7,232)	(3,718)	(0)	(0)	(0)	(16,656)	(6,330)	(−10,326)	(20,170)	(13,562)	(−6,608)
Species total	1,849	2,930	1,081	35	17	−18	106,904	83,257	−23,647	108,788	86,203	−22,585
	(4,569)	(7,240)	(2,671)	(87)	(41)	(−46)	(264,156)	(205,724)	(−58,432)	(268,812)	(213,005)	(−55,807)
Greene's Tuctoria:												
Unit 1	903	619	−284	0	0	0	70	70	0	972	689	−283
	(2,231)	(1,530)	(−701)	(0)	(0)	(0)	(172)	(172)	(0)	(2,403)	(1,703)	(−700)
Unit 2	0	0	0	0	0	0	11,673	10,159	−1,514	11,674	10,159	−1,515
	(0)	(0)	(0)	(1)	(0)	(−1)	(28,844)	(25,102)	(−3,742)	(28,845)	(25,102)	(−3,743)
Unit 3	0	0	0	0	0	0	979	979	0	979	979	0
–	(0)	(0)	(0)	(0)	(0)	(0)	(2,418)	(2,418)	(0)	(2,418)	(2,418)	(0)
Unit 4	0	0	0	0	0	0	299	125	−174	299	125	−174
–	(0)	(0)	(0)	(0)	(0)	(0)	(738)	(309)	(−429)	(738)	(309)	(−429)
Unit 5	5,187	1,307	−3,880	0	0	0	531	1	−530	5,718	1,308	−4,410
–	(12,816)	(3,230)	(−9,586)	(0)	(0)	(0)	(−1,313)	(3)	(−1,310)	(14,129)	(3,233)	(−10,896)
Unit 6	0	0	0	0	0	0	36,414	29,588	−6,826	−36,414	29,588	−6,826
–	(0)	(0)	(0)	(0)	(0)	(0)	(89,978)	(73,111)	(−16,867)	(89,978)	(73,111)	(−16,867)
Unit 7	427	3	−424	11	0	−11	73,269	54,008	−19,261	73,707	54,011	−19,695
–	(1,056)	(8)	−(1,048)	(26)	(0)	(−26)	(181,045)	(133,452)	(−47,593)	(182,127)	(133,460)	(−48,667)
Unit 8	0	0	0	0	0	0	13,222	11,126	−2,096	13,222	11,126	−2,096
	(0)	(0)	(0)	(0)	(0)	(0)	(32,670)	(27,491)	(−5,179)	(32,670)	(27,491)	(−5,179)
Species total	−6,517	1,929	−4,587	−11	0	−11	136,456	106,055	−30,401	142,984	107,985	−34,999
	(16,103)	(4,768)	(−11,335)	(27)	(0)	(−27)	(337,178)	(262,059)	(−75,119)	(353,308)	(266,827)	(−86,481)
Hairy Orcutt Grass:												
Unit 1	0	0	0	0	0	0	8,748	7,813	−935	8,748	7,813	−935
	(0)	(0)	(0)	(0)	(0)	(0)	(21,617)	(19,306)	(−2,311)	(21,617)	(19,306)	(−2,311)
Unit 2	0	0	0	0	0	0	979	979	0	979	979	0
	(0)	(0)	(0)	(0)	(0)	(0)	(2,418)	(2,418)	(0)	(2,418)	(2,418)	(0)

TABLE 1.—APPROXIMATE AREAS OF CRITICAL HABITAT FOR THE VERNAL POOL CRUSTACEANS AND PLANTS IN CALIFORNIA AND OREGON—Continued

	Federal lands			State/County lands			Private lands			Total lands		
	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)	Proposed hectare (acres)	Final hectares (acres)	Change hectares (acres)
Unit 3	5,187	1,307	−3,880	−0	0	0	531	1	−530	5,718	1,308	4,410
	(12,816)	(3,230)	(−9,586)	(0)	(0)	(0)	(1,313)	(3)	(−1,310)	(14,129)	(3,233)	(−10,896)
Unit 4	7	7	0	25	17	−8	25,286	19,664	−5,622	25,318	19,688	−5,630
	(17)	(17)	(0)	(61)	(41)	(−20)	(62,482)	(48,590)	(−13,892)	(62,560)	(48,649)	(−13,911)
Unit 5	0	0	0	0	0	0	9,085	9,029	−56	9,085	9,029	−56
	(0)	(0)	(0)	(0)	(0)	(0)	(22,448)	(22,311)	(−137)	(22,448)	(22,311)	(−137)
Unit 6	0	0	0	4	0	−4	15,820	14,426	−1,394	15,824	14,426	−1,398
	(0)	(0)	(0)	(10)	(0)	(−10)	(39,090)	(35,646)	(−3,444)	(39,100)	(35,646)	(−3,454)
Species total	5,194	1,314	−3,880	29	17	−12	60,449	51,912	−8,537	65,671	53,243	−12,428
	(12,833)	(3,247)	(−9,586)	(71)	(41)	(−30)	(149,368)	(128,274)	(−21,094)	(162,272)	(131,562)	(−30,710)
Sacramento Orcutt Grass:												
Unit 1	0	0	0	3	3	0	26	11	−16	29	14	−15
	(0)	(0)	(0)	(7)	(7)	(0)	(65)	(27)	(−38)	(72)	(34)	(−38)
Unit 2	0	0	0	0	0	0	8,853	6,774	−2,079	8,853	6,774	−2,079
	(0)	(0)	(0)	(0)	(0)	(0)	(21,875)	(16,738)	(−5,137)	(21,875)	(16,738)	(−5,137)
Unit 3	0	0	0	247	0	−247	15,503	14,196	−1,307	15,750	14,196	−1,554
	(0)	(0)	(0)	(610)	(0)	(−610)	(38,308)	(35,078)	(−3,230)	(38,918)	(35,078)	(−3,840)
Species total	0	0	0	250	3	−247	24,382	20,981	−3,402	24,632	20,984	−3,649
	(0)	(0)	(0)	(617)	(7)	(−610)	(60,248)	(51,842)	(−8,406)	(60,865)	(51,850)	(−9,015)
San Joaquin Valley Orcutt Grass:												
Unit 1	427	3	−424	11	0	−11	45,205	37,685	−7,521	45,643	37,688	−7,955
	(1,056)	(8)	(−1,048)	(26)	(0)	(−26)	(111,701)	(93,118)	(−18,583)	(112,783)	(93,125)	(−19,658)
Unit 2	0	0	0	0	0	0	21,495	13,012	−8,483	21,495	13,012	−8,483
	(0)	(0)	(0)	(0)	(0)	(0)	(53,114)	(32,152)	(−20,962)	(53,114)	(32,152)	(−20,962)
Unit 3	0	0	0	0	0	0	20,936	18,267	−2,669	20,936	18,267	−2,669
	(0)	(0)	(0)	(0)	(0)	(0)	(51,733)	(45,137)	(−6,596)	(51,733)	(45,137)	(−6,596)
Unit 4	0	0	0	0	0	0	3,233	3,016	−218	3,234	3,016	−218
	(0)	(0)	(0)	(1)	(0)	(−1)	(7,989)	(7,451)	(−538)	(7,990)	(7,451)	(−539)
Unit 5 A–B	150	142	−8	0	170	170	1,573	1,412	−162	1,723	1,723	0
	(370)	(350)	(−20)	(0)	(419)	(419)	(3,888)	(3,488)	(−400)	(4,258)	(4,258)	(0)
Unit 6 A–B	0	0	0	199	88	−111	7,829	6,081	−1,748	8,028	6,169	−1,859
	(0)	(0)	(0)	(491)	(218)	(−273)	(19,345)	(15,026)	(−4,319)	(19,836)	(15,243)	(−4,593)
Species total	577	145	−432	210	258	48	100,273	79,472	−20,801	101,059	79,875	−21,185
	(1,426)	(358)	−(1,068)	(518)	(637)	(119)	247,770	196,373	(−51,397)	(249,714)	(197,367)	(−52,347)
Slender Orcutt Grass:												
Unit 1 A–I	18,527	9,306	−9,221	37	0	−37	4,702	1,699	−3,003	23,266	11,005	−12,261
	(45,780)	(22,994)	(−22,786)	(92)	(0)	(-92)	(11,618)	(4,198)	(−7,420)	(57,490)	(27,192)	(−30,298)
Unit 2 A–C	33	33	0	0	0	0	5,067	4,161	−906	5,100	4,194	−905
	(81)	(81)	(0)	(0)	(0)	(0)	(12,520)	(10,282)	(−2,238)	(12,601)	(10,364)	−2,237)
Unit 3	6,226	6,005	−221	437	287	−150	13,783	13,465	−318	20,446	19,757	−689
	(15,384)	(14,839)	(−545)	(1,080)	(709)	(−371)	(34,058)	(33,272)	(−786)	(50,522)	(48,820)	(−1,702)
Unit 4	0	0	0	0	0	0	11,673	10,159	−1,514	11,674	10,159	−1,515
	(0)	(0)	(0)	(1)	(0)	(−1)	(28,844)	(25,102)	(−3,742)	(28,845)	(25,102)	(−3,743)
Unit 5 A–B	0	0	0	5	5	0	1,691	1,691	0	1,696	1,696	0
	(0)	(0)	(0)	(13)	(13)	(0)	(4,178)	(4,178)	(0)	(4,191)	(4,191)	(0)
Unit 6	0	0	0	0	0	0	8,853	6,774	−2,079	8,853	6,774	−2,079
	(0)	(0)	(0)	(0)	(0)	(0)	(21,875)	(16,738)	(−5,137)	(21,875)	(16,738)	(−5,137)
Species total	24,786	15,344	−9,442	480	292	−188	45,769	37,949	−7,820	71,035	53,585	−17,450
	(61,245)	(37,914)	(−23,331)	(1,186)	(721)	(−465)	(113,093)	(93,771)	(−19,322)	(175,524)	(132,406)	(−43,118)

Note: Table area estimates do not reflect the exclusion of National Wildlife Refuge lands, National fish hatchery lands, State lands within ecological reserves and wildlife management areas, and lands within the following California counties: Butte, Madera, Merced, Sacramento, and Solano from the final designation pursuant to section 4(b)(2) of the Act.

Table 2. Land ownership of approximate areas of critical habitat for the vernal pool crustaceans and plants in California and Oregon.

VERNAL POOL CRITICAL HABITAT—OWNERSHIP FOR ALL UNITS COMBINED

	Proposed critical habitat		Final critical habitat		Amount of change	
	Hectares	(Acres)	Hectares	(Acres)	Hectares	(Acres)
Federal:						
Air Force	6,276	(15,509)	0	(1)	−6,276	(−15,508)
Army	22,538	(55,692)	2,928	(7,234)	−19,610	(−48,458)
Other Military	258	(638)	140	(345)	−119	(−293)
BLM	12,007	(29,671)	15,155	(37,449)	3,148	*(7,778)
Bureau of Reclamation	8	(20)	8	(20)	0	(0)
Fish and Wildlife Service	22,153	(54,742)	13,394	(33,097)	−8,759	(−21,645)
Forest Service	36,901	(91,185)	29,590	(73,118)	−7,311	(−18,067)
National Park Service	60	(148)	2	(5)	−58	(−143)

VERNAL POOL CRITICAL HABITAT—OWNERSHIP FOR ALL UNITS COMBINED—Continued

	Proposed critical habitat		Final critical habitat		Amount of change	
	Hectares	(Acres)	Hectares	(Acres)	Hectares	(Acres)
Total Federal	100,203	(247,605)	61,216	(151,268)	−38,986	(−96,337)
State/County/City:						
City/County Park	2	(4)	0	(0)	−2	(−4)
CDFG	5,529	(13,662)	1,363	(3,369)	−4,165	(−10,293)
State	79	(194)	0	(0)	−79	(−194)
State Land Commission	260	(642)	318	(787)	59	*(145)
State Parks & Recreation	1,447	(3,575)	17	(41)	−1,430	(−3,534)
Total State/County/City	7,316	(18,077)	1,698	(4,197)	−5,617	(−13,880)
Private (Conservation):						
CDFG Administered	33,873	(83,701)	390	(963)	−33,483	(−82,738)
Other Conservancy	453	(1,120)	0	(0)	−453	(−1,120)
TNC ** Owned	8,844	(21,853)	7,687	(18,995)	−1,157	(−2,858)
TNC Easement	17,383	(42,954)	16,676	(41,207)	−707	(−1,747)
WRP ** Easement	688	(1,699)	617	(1,525)	−70	(−174)
Total Private (Conservation)	61,240	(151,327)	25,370	(62,690)	−35,870	(−88,637)
Private (All Other)	502,972	(1,242,866)	418,012	(1,032,489)	−84,960	(−209,851)
Grand Total	671,730	(1,659,875)	502,488	(1,241,145)	−169,242	(−418,027)

* Increase in acreage shown for these categories is due to use of updated ownership data for final critical habitat calculations. Updated data was received after proposed critical habitat calculations had been completed.

** TNC = The Nature Conservancy; WRP = Wetlands Reserve Program

Note: Table area estimates do not reflect the exclusion of National Wildlife Refuge lands, National fish hatchery lands, State lands within ecological reserves and wildlife management areas, and lands within the following California counties: Butte, Madera, Merced, Sacramento, and Solano from the final designation pursuant to section 4(b)(2) of the Act.

Description of Species Specific Criteria and Critical Habitat Units

As discussed in the''Exclusions Under Section 4(b)(2) of the Act'' section of this final rule, we have excluded from the final designation National Wildlife Refuge lands, National fish hatchery lands, State wildlife areas and ecological reserves, as well as all critical habitat units in the following California counties: Butte, Madera, Merced, Sacramento, and Solano. The descriptions below are for the units entirely or partially included in the final critical habitat designation. The descriptions, including acreage of units, do not necessarily reflect all of the subsequent exclusions of areas pursuant to section 4(b)(2) of the Act in the final designation. Please refer to that section of the rule for additional discussion of areas excluded from the final designation.

Except where otherwise noted, all units contain known occurrences of the species in question, as well as both of the PCEs listed above, and at least one of the specific PCEs of the species (*e.g.*, involving specific soil types, ponding depths). Each unit was chosen for its ability to advance at least one of the conservation criteria listed above.

Conservancy Fairy Shrimp

Most occurrences of Conservancy fairy shrimp are limited to large clay-bottomed pools that are rare within the vernal pool landscapes within California (Vollmar 2002). Helm (1998) observed that most Conservancy fairy shrimp occurrences were on Anita, Pescadero, or Peters Clay soils. Conservancy fairy shrimp are typically found in turbid and large ((0.4 ha to 0.8 ha)(1 to 2 ac)) to very large ((35 ha (88 ac)) vernal pools (Helm and Vollmar 2002). However, the pools inhabited by conservancy fairy shrimp near the Montezuma Hills in Solano County and in Butte County are relatively small and have a low turbidity (Vollmar 2002). The species is found in large playa pools on Tuscan or Mehrten geologic formations and on Basin Rim landforms in Tehama, Merced, and Solano Counties (Helm 1998) on various soil types. The parent material of vernal pools greatly influences species composition and hydrologic functioning of the vernal pool (Hanes and Stromberg 1998; Smith and Verrill 1998). Soils beneath vernal pools are extremely variable and are not the same as soils mapped by soil surveys, but are usually undescribed hydric inclusions that vary by location (Holland and Dain 1990). The Vina Plains area in Tehama County supports occurrences of the species within numerous large pools throughout the area (Eriksen and Belk 1999; Helm 1998; Helm and Vollmar 2002). The pools in the Sacramento National Wildlife Refuge area in Glenn and Colusa Counties as well as in parts of the San Luis National Refuge Complex in Merced County are associated with alkaline sink areas and tend to be higher in pH and salinity than in other pools where the species is found. The primary constituent elements of critical habitat for Conservancy fairy shrimp are the habitat components that provide:

(i) Vernal pools, swales, and other ephemeral wetlands and depressions of appropriate sizes and depths that typically become inundated during winter rains and hold water for sufficient lengths of time necessary for Conservancy fairy shrimp incubation, reproduction, dispersal, feeding, and sheltering, including but not limited to large playa vernal pools often found on basin rim landforms and alkaline soils, but which are dry during the summer and do not necessarily fill with water every year; and

(ii) The geographic, topographic, and edaphic features that support aggregations or systems of hydrologically interconnected pools, swales, and other ephemeral wetlands and depressions within a matrix of surrounding uplands that together form hydrologically and ecologically functional units called vernal pool complexes.

These features contribute to the filling and drying of the vernal pool and

maintain suitable periods of pool inundation, water quality, and soil moisture for vernal pool crustacean hatching, growth and reproduction, and dispersal, but not necessarily every year.

Unit 1, Vina Plains Unit, Butte and Tehama Counties (41,733 ac (16,890 ha))

This unit contains vernal pools found on Anita clay and Tuscan loam soils (EPA 1994; Holland 1998; Tehama County 1999; USDA 2001), and represents the northern extent of Conservancy fairy shrimp range. Conservancy fairy shrimp in this area occupy vernal pools that are classified as Northern Hardpan by Sawyer and Keeler-Wolf (1995) and occur on the Tuscan, Red Bluff, and Riverbank geologic formations. Within this unit vernal pools occur in complexes with a range of pool sizes, from over several acres (hectares) to less than a 0.1 ac (500 m^2), in areas of hummocky ground on old terraces above recent river flood plains below the foothills (Alexander and Schlising 1997; Keeler-Wolf *et al.* 1998). The unit is essential to ensure the conservation of the species in general, as well as in the northern extent of its range (criterion 1). It is also essential to the conservation of the ecological distribution of the species, because of the wide range of occupied pool sizes and because the combination of soils, geologic formations, and pool type is not otherwise well represented for the species (criterion 2). The unit is also important because it includes relatively undisturbed, hydrologically intact vernal pool habitats that will likely continue to support natural vernal pool ecosystem processes and meet the appropriate habitat conditions for Conservancy fairy shrimp (criterion 4), and because it provides seasonal habitat for waterfowl and other migratory bird species that aid in the dispersal of Conservancy fairy shrimp among vernal pools within the unit, as well as between other habitats across the species range (criterion 3).

The majority of the lands included within this unit are privately owned. This unit contains The Nature Conservancy's (TNC) Vina Plains preserve as well as other TNC lands 5,660 ac (2,264 ha) and conservation easements 10,870 ac (4,348 ha). The Natural Resource Conservation Services (NRCS) also holds Wetlands Reserve Program (WRP) conservation easements or agreements on 142 ac (57 ha).

The Vina Plains Unit extends from south of Deer Creek to north of Rock Creek and the Chico Airport near the City of Chico. State Highway 99 bisects this unit. The western boundary generally parallels the Southern Pacific Railway line. The eastern boundary of this unit extends to the boundary of the East Red Bluff watershed.

Unit 6, Merced Unit, Merced and Mariposa Counties (132,902 ac (53,785 ha))

This unit contains Conservancy fairy shrimp occurrences within large playa vernal pools found on Raynor Cobbly clay soils on the Mehrten Formation (EIP Associates 1999; CNDDB 2001). This soil and geologic formation combination is not represented by any of the other units (criterion 2). The Merced Unit encompasses the largest block of pristine, high-density vernal pool grasslands remaining in California (Vollmar 2002). The relatively undisturbed, hydrologically intact condition of the unit increases the likelihood that it will continue to support natural vernal pool ecosystem processes and maintain suitable habitat conditions for Conservancy fairy shrimp (criterion 4). The Conservancy fairy shrimp occurrence at the Flying M Ranch is already being managed through a conservation easement with TNC that conserves over 5,000 ac (2,023 ha) of vernal pool and upland habitat (criterion 4). Land ownership within the unit includes approximately 8 ac (3 ha) of Federal lands and TNC has a total of 11,283 ac (4,513 ha) of conservation easements within this unit.

A majority of the vernal pool habitat in the Merced Unit is in eastern Merced County. The eastern edge of the unit overlaps into western Mariposa County, and in the south, it extends to Deadman Creek. The northern boundary parallels the Merced River. The unit is located east of Highway 99 and the City of Merced, Planada, and Le Grand. The eastern boundary extends into the low elevation foothills of the Sierra Nevada.

Unit 8, Ventura County Unit, Ventura County (46,531 ac (18,831 ha))

The Ventura County Unit is located in the north-central portion of Ventura County. With the exception of 1,951 ac (790 ha) that are privately owned, all other land within this unit occurs within the Los Padres National Forest. Vernal pool fairy shrimp and Conservancy fairy shrimp co-occur at relatively high-elevation (5,500 ft (1,700 m)) forested sites within this unit. This combination of attributes is ecologically unique because these species normally occur at much lower elevations in grassland habitat. The critical habitat perimeter encompasses an area that is known to contain vernal pool and Conservancy fairy shrimp and isolated pools that provide habitat for both species. Few fairy shrimp surveys exist for this unit. However, listed fairy shrimp probably occur at several additional locations with suitable ephemeral aquatic habitat. A further potential benefit of designating this unit is that it may help to promote efforts to identify and proactively manage such locations, which are not typically associated with these invertebrates. The Ventura County Unit is essential for the conservation of Conservancy fairy shrimp because it contains high elevation ephemeral aquatic environments that are rarely associated with fairy shrimp (criterion 2). This unit also represents the extreme southern end of the species range, and is 124 mi (200 km) from other species occurrences in the Great Central Valley (criterion 1).

Longhorn Fairy Shrimp Criteria

Longhorn fairy shrimp occurrences are highly disjunct and scarce within the geographic range in which they occur. There are fewer areas in which this species is known to occur than any other listed vernal pool crustacean. The specific pool characteristics that determine suitability for longhorn fairy shrimp reproduction and growth are not well understood. We identified critical habitat areas essential to the conservation of longhorn fairy shrimp in three areas in which it is known to occur. In determining areas that are essential to conserve longhorn fairy shrimp, we used the best scientific and commercial data available. Longhorn fairy shrimp occurrences are known from Contra Costa County to San Luis Obispo County with an elevational variation of near 15 m (50 ft) to near 600 m (2,000 ft). A broad distribution of longhorn fairy shrimp across its geographical and elevational distribution protects the natural environmental processes for the species and provides the best chance for retaining the species across the full extent of the species range. The vernal pool types and soils associated with the three general areas of concentration of longhorn fairy shrimp differ greatly across the geographic range of the species and leads to different species compositions and environmental conditions between longhorn fairy shrimp occurrences. Providing for a mosaic of habitat types both between and among vernal pool species is essential because it would include the full extent of the physical and environmental conditions for the species (Fugate 1992; Fugate 1998; Gonzales *et al.* 1996; Ikeda and Schlising 1990; Noss *et al.* 2002a, Platenkamp 1998; Zedler *et al.* 1979). The Altamont Pass subunits (unit 1abc)

support occurrences of the species within clear depression pools in sandstone outcrops (Eriksen and Belk 1999; EBRPD 2001; CNDDB 2002). Midway in the species' range, the alkaline pools supporting longhorn fairy shrimp are found on Edminster loam and Turlock sandy loam. In the species' southern range, they are found on shallow alkaline Northern Claypan type vernal pools within a valley saltbush scrub matrix. The parent material of vernal pools greatly influences species composition and hydrologic functioning of the vernal pool (Hanes and Stromberg 1998; Holland and Jain 1981, 1988). Soils beneath vernal pools are extremely variable and are not the same as soils mapped by soil surveys, but are usually undescribed hydric inclusions which vary upon location (Holland and Dain 1990). The primary constituent elements of critical habitat for longhorn fairy shrimp are the habitat components that provide:

(i) Vernal pools, swales, and other ephemeral wetlands and depressions of appropriate sizes and depths that typically become inundated during winter rains and hold water for sufficient lengths of time necessary for longhorn fairy shrimp incubation, reproduction, dispersal, feeding, and sheltering, including but not limited to, large playa vernal pools often on basin rim landforms and alkaline soils, but which are dry during the summer and do not necessarily fill with water every year; and

(ii) The geographic, topographic, and edaphic features that support aggregations or systems of hydrologically interconnected pools, swales, and other ephemeral wetlands and depressions within a matrix of surrounding uplands that together form hydrologically and ecologically functional units called vernal pool complexes. These features contribute to the filling and drying of the vernal pool and maintain suitable periods of pool inundation, water quality, and soil moisture for vernal pool crustacean hatching, growth and reproduction, and dispersal, but not necessarily every year.

Unit 1, Altamont Hills Unit A and B, Contra Costa and Alameda Counties (791 ac (320 ha))

This unit supports occurrences of the species within clear depression pools in sandstone outcrops (Eriksen and Belk 1999; EBRPD 2001; CNDDB 2002). The essential habitat for the species occurs in sandstone rock outcroppings with the pools sometimes being less than a meter (3 ft) across. This is a unique habitat for longhorn fairy shrimp, and helps to maintain a diversity of habitats for the species (criterion 2). The Altamont Hills Unit is also an important area for the species because it represents the northern limit of its range, and is one of only three locations where the species is known to occur (criterion 1).

This unit is located in Altamont Hills north and northeast of the City of Livermore, and consists of two subunits, both near the Contra Costa and Alameda County line. Subunit A is located in Contra Costa County directly north of the Alameda County line near the Vasco Caves. Subunit B is located directly in Alameda County just south of the Contra Costa County line in the vicinity of Brushy Peak. This unit is located primarily on East Bay Regional Park District and Contra Costa Water District land.

Unit 3, Carrizo Plain Unit, San Luis Obispo, Kern, and Monterey Counties (10,466 ha (25,862 ac))

This unit contains occurrences of the species living within Northern Claypan type vernal pools as described by Sawyer and Keeler-Wolf (1995) (CNDDB 2001). Longhorn fairy shrimp in the Carrizo Unit are found in shallow alkaline vernal pools within a valley saltbush scrub matrix. These ecological characteristics are not represented by the other units (criterion 2). The Carrizo Plain Unit also represents the southern extent of the range of longhorn fairy shrimp (criterion 1).

This unit is located in the vicinity of California Valley and Soda Lake. State Highway 58 is located north of the unit. Most of the habitat is east of Soda Lake Road. To the east, the unit is bordered by the San Andreas Rift Zone. The Carrizo Plain Unit contains portions of the Carrizo Plain National Monument administered by the BLM, TNC, and the CDFG. The BLM lands within the unit total approximately 15,549 ac (6,220 ha), and CDFG lands total approximately 234 ac (95 ha). Other vernal pool habitats in the unit are located on private land.

Vernal Pool Fairy Shrimp

Vernal pool fairy shrimp are distributed across a large geographic range from southern Oregon to southern California (Eriksen and Belk 1999). Although the habitat of vernal pool fairy shrimp is highly fragmented and occurrences are isolated from each other by varying degrees across the species' range, the distribution of remaining extant occurrences is somewhat evenly spread throughout its range. Vernal pool fairy shrimp occur in a wide variety of habitat types from the Agate Desert area in southern Oregon, to throughout the Sacramento and San Joaquin valleys, the central Coast Range, and into Riverside County, California. Although some of the habitat characteristics of the species are known, specific pool characteristics that determine suitability for vernal pool fairy shrimp hatching, growth, and reproduction are not well understood. Vernal pool fairy shrimp occurrences are known to occur in eight general areas of concentration on basin rim, low terrace, high terrace, volcanic mudflow, valley floor, alkaline playa, and coastal mountain landforms. The elevational differences in the distribution of vernal pool fairy shrimp range from near 8 m (25 ft) in the Central and Sacramento Valleys to near 150 m (500 ft) in Shasta County. A broad distribution of vernal pool fairy shrimp across its geographical and elevational distribution protects the natural environmental processes for the species and provides the best chance for retaining the species across the full extent of the species' range.

The vernal pool types and soils associated with the eight general areas of concentration of vernal pool fairy shrimp differ greatly across the geographic range of the species and lead to different species compositions and ecological conditions between vernal pool fairy shrimp occurrences. Providing for a mosaic of habitat types both between and among vernal pool species is essential because it would include the full extent of the physical and environmental conditions for the species (Barclay and Knight 1984; Bauder and McMillan 1998; Fugate 1992, 1998; Gonzales *et al.*1996; Noss *et al.* 2002a; Noss *et al.* 2002b; Platenkamp 1998; Zedler *et al.* 1979).

Vernal pool fairy shrimp are usually found in vernal pools (79%), although they are sometimes found in a range of natural and artificially created ephemeral habitats such as alkali pools, seasonal drainages, stock ponds, vernal swales, and rock outcrops (Vollmar 2002). Vernal pool fairy shrimp are most frequently found in small ((<200 m^2)(<2,125 ft^2)) and shallow ((mean of 5 cm)(2 in)) pool habitats; however, this species can be found in large (44,534 m^2)(480,967 ft^2) and very deep (122 cm) (48 in) pool habitats as well (Helm and Vollmar 2002). The landform associations for the vernal pool fairy shrimp include alluvial fans, bedrock, bedrock escarpments, basin rim, floodplain, high terrace, stream terrace, volcanic mudflow, and low terrace formations (Helm 1998). The soils that contain occurrences of vernal pool fairy shrimp in the delineated units vary significantly throughout the species' range. In the north, the rare Northern Mudflow formation underlies vernal pools in Shasta and Tehema Counties.

Tehema and Butte Counties contain Northern Basalt Flow vernal pools that are limited to ancient terraces and hilltops that comprise some of the oldest geologic formations in California. Northern Volcanic Mudflow vernal pools are delineated in Butte and Yuba Counties. Throughout the Central Valley, the habitat ranges from high terrace landforms to claypan and hardpan pool types. Northern Basalt Flow vernal pools are found in Fresno County in the low elevation foothills. In the Suisun Marsh area, vernal pool fairy shrimp are found in the saline-alkaline transition zone. The parent material of vernal pools greatly influences species composition and hydrologic functioning of the vernal pool (Hanes and Stromberg 1998; Holland and Jain 1981, 1988). Soils beneath vernal pools are extremely variable and are not the same as soils mapped by soil surveys, but are usually undescribed hydric inclusions which vary upon location (Holland and Dain 1990). The primary constituent elements of critical habitat for vernal pool fairy shrimp are the habitat components that provide:

(i) Vernal pools, swales, and other ephemeral wetlands and depressions of appropriate sizes and depths that typically become inundated during winter rains and hold water for sufficient lengths of time necessary for vernal pool fairy shrimp incubation, reproduction, dispersal, feeding, and sheltering, including but not limited to Northern Hardpan, Northern Claypan, Northern Volcanic Mud Flow, and Northern Basalt Flow vernal pools formed on a variety of geologic formations and soil types, but which are dry during the summer and do not necessarily fill with water every year; and

(ii) The geographic, topographic, and edaphic features that support aggregations or systems of hydrologically interconnected pools, swales, and other ephemeral wetlands and depressions within a matrix of surrounding uplands that together form hydrologically and ecologically functional units called vernal pool complexes. These features contribute to the filling and drying of the vernal pool, and maintain suitable periods of pool inundation, water quality, and soil moisture for vernal pool crustacean hatching, growth and reproduction, and dispersal, but not necessarily every year.

Oregon

Vernal pool fairy shrimp is the only species addressed in this final rule that occurs in Oregon. Four units in Oregon are designated as essential to the conservation of vernal pool fairy shrimp, and there are 29 units in California. The Oregon units occur approximately 200 km (125 mi) north of the nearest unit designated for this species in California. We identified critical habitat areas essential to the conservation of vernal pool fairy shrimp to reflect the species geographic distribution and varying habitat types and species associations across its range. Maintaining vernal pool fairy shrimp across their full geographic distribution would make the species less susceptible to environmental variation or negative impacts associated with human disturbances or natural catastrophic events across the species entire range at any one time (Grosberg 2002, Helm 1998; Hunter 1996, New 1995, Primack 1993; Redford and Richter 1999; Rossum *et al.* 2001). Variation in environmental conditions such as precipitation amount, precipitation timing, and temperature, influence vernal pool species including hatching and reproduction of vernal pool fairy shrimp from year to year (Eriksen and Belk 1999, Grosberg 2002, Helm 1998, Helm and Vollmar 2002, Service 1994c, Simovich 1998).

Unit 1A, B, C ,D, E, F, and G, North Agate Desert Unit, Jackson County (2,130 ac (862 ha))

This unit consists of seven subunits, all located to the north of Little Butte Creek. This unit represents the northern limit of the species' distribution (criterion 1). It is of sufficient size to sustain the natural ecosystem processes (*e.g.*, fires) that have historically influenced vernal pool habitat, and is separated from the nearest other unit designated for Oregon, Unit 4, by over 2 mi (3.2 km). Three of the subunits are west of the Rogue River, and the remaining four are to the east. All but one of these subunits are located to the south of U.S. Route 234 (Sam's Valley Highway). The one remaining unit is located to the east of the Rogue River, about 1.5 mi (2.4 km) north of the confluence with Reese Creek.

Unit 2A, B, C, D, and E, White City East Unit, Jackson County (2,251 ac (911 ha))

This unit consists of five subunits, located east of U.S. Route 62 (Crater Lake Highway) and south and southeast of Dutton Road. This unit provides the easternmost extent of the species' range in Oregon (criterion 1). It represents a significant component of the species' original range in the State and is of a sufficient size to sustain the natural ecosystem processes (*e.g.*, fires) that have historically influenced vernal pool habitat (Borgias 2003). The largest and easternmost of the subunits occurs just to the east and north of Agate Lake. It is separated by more than 1 mi (1.6 km) from Unit 3, White City West, and by approximately 3.5 mi (5.6 km) from the North Agate Desert Unit.

Unit 3A, B, and C, White City West Unit, Jackson County (2,301 ac (931 ha))

This unit consists of three subunits, located west of Agate Road, south of the Rogue River, and east of Bear Creek. This unit contains the least fragmented intact examples of the original Agate Desert mounded vernal pool grassland habitat (criterion 3). It is of sufficient size to sustain the natural ecosystem processes (*e.g.*, fires) that have historically influenced vernal pool habitat; it is separated from the White City East Unit by more than 1 mi (1.6 km) and from the Table Rocks Unit by over 1.5 mi (2.4 km).

We believe that, taken together, the designated Agate Desert units (Units 1–3) comprise a functional vernal pool complex consisting of vernal pools, mounded grassland and associated uplands, where natural processes, including connectivity, function within or near the natural range of variability. Each of the three designated Agate Desert units is essential to the conservation of vernal pool fairy shrimp in the Agate Desert.

Unit 4A and B, Table Rocks Unit, Jackson County (892 ac (361 ha))

This unit consists of two subunits, located on two flat-topped mesas known as Upper and Lower Table Rocks, situated north and west of the Rogue River. These rimrock features are remnants of ancient lava flows that filled portions of the Rogue River nearly 10 million years ago (BLM 1998). Subsequent erosion of softer geologic layers has left these harder andesite (volcanic rock) formations rising some 800 ft (245 m) above the present Rogue Valley. Vernal pools on the Table Rocks differ from those of the Agate Desert, in that they are formed over an impervious layer of bedrock. This unit represents a unique habitat for vernal pool fairy shrimp in Oregon (criterion 2). The Table Rocks Unit is disjunct from the North Agate Desert Unit by over 2 mi (3.2 km), and from the White City West Unit by approximately 1.5 mi (2.4 km).

California

Unit 5, Redding Unit, Shasta County (3,666 ac (1,485 ha))

This unit contains the largest intact vernal pool habitat in the Sacramento Valley and represents the northern portion of vernal pool fairy shrimp's range in California (criteria 1 and 4).

Occurrences of the species (CNDDB 2002) within vernal pools mapped by Holland (1998) are found on old alluvial terraces above the Sacramento River and often on Redding and Corning soil complexes (Shasta County 2001). Generally these pools are small in size, although the Stillwater Plains area supports unique pools that are several acres in size.

Most of the land included within this unit is privately owned. The BLM owns 41 ac (17 ha) within this unit, and 130 ac (52 ha) of private land is protected under conservation easement or agreement as part of the WRP. The Stillwater Plains Conservation Bank, specifically established to contribute to the recovery of vernal pool fairy shrimp, is located within this unit, thereby increasing the likelihood that the unit will persist (criterion 4). The City of Redding and other local and State planning organizations are currently developing an HCP to provide for the conservation of vernal pool fairy shrimp. This unit would provide an area where conservation efforts for vernal pool fairy shrimp could take place.

This unit is located in the area east of the Redding Municipal Airport between Airport Road to the west and Deschutes Road to the east. The unit extends to Dersch Road in the south and towards Lassen Park Highway in the north. This unit comprises a portion of the Stillwater Plains.

Unit 6, Red Bluff Unit, Tehama County (39,629 ac (16,038 ha))

This unit contains vernal pools formed on alluvial terraces west of the Sacramento River and associated with Newville/Corning and Redding/Corning soil complexes (USDA 2001) exhibiting well-developed mima mound topography. The vernal pools within this unit are generally small and may not be inundated long enough to support other longer-lived vernal pool species.

This unit contains several large (*e.g.*, over 10,000 ac (4,068 ha)) vernal pool habitat complexes. These areas are relatively undisturbed, hydrologically intact vernal pool habitats that will likely continue to support natural vernal pool ecosystem processes and maintain suitable habitat conditions for vernal pool fairy shrimp (criterion 4). This unit also provides essential habitat for migratory waterfowl that aid in the dispersal of vernal fairy shrimp and other vernal pool crustacean cysts (criterion 3).

The majority of the lands included within this unit are privately owned, although CDFG owns 430 ac (174 ha) within this unit. This unit also contains large private conservation areas established specifically to contribute to the recovery of vernal pool fairy shrimp and compensate for the loss of vernal pool habitat, including the 5,000-ac (2,023-ha) Tehama Fiber Farm mitigation area (criterion 4). CDFG's Thomes Creek Ecological Reserve is also located within this unit.

This unit extends from southwest of Red Bluff at Red Bank Creek south to Thomes Creek. The eastern boundary includes the vernal pool habitat from the Southern Pacific Railroad near Coyote Creek south paralleling Interstate 5 to Thomes Creek.

Unit 7, Vina Plains Unit, Tehama and Butte Counties (48,588 ac (19,663 ha))

This unit contains Northern Volcanic Mudflow vernal pools. These pools are generally small and tend to be inundated for relatively short periods of time. Vernal pool fairy shrimp are also found within larger vernal pools forming on hardpans within this unit. These pools tend to be larger and longer lasting than Northern Volcanic Mudflow pools, providing a variety of habitats available for the species to expand and contract in size and place over time.

The pool types within this unit maintain the diversity of habitats in which vernal pool fairy shrimp are known to occur and provide relatively undisturbed, hydrologically intact vernal pool habitats that will likely continue to support natural vernal pool ecosystem processes and maintain suitable habitat conditions for vernal pool fairy shrimp (criterion 4). This unit also provides habitat for migratory waterfowl that aid in the dispersal of vernal pool fairy shrimp and other vernal pool crustacean cysts (criterion 3).

The majority of the lands included within this unit are privately owned. This unit contains TNC's Vina Plains preserve as well as other TNC lands (5,660 ac (2,264 ha)) and conservation easements (10,870 ac (4,348 ha)), thereby increasing the likelihood that the habitat will persist (criterion 4). Other ownership within this unit includes 142 ac (57 ha) of private land protected under conservation easement or agreement under the NRCS's WRP.

This unit is located in the northeastern portion of the Sacramento Valley from Deer Creek in Tehama County to Chico in Butte County. The unit extends south and east of the Sacramento River paralleling the low elevation foothill region of the Sierra Nevada and represents the northeastern extent of vernal pool fairy shrimp's range in California.

Unit 8, Orland Unit, Tehama County (12,676 ac (5,130 ha))

This unit contains vernal pools formed on alluvial terraces of Northern Hardpan formations west of the Sacramento River and associated with Anita clay and Tuscan loam soils (USDA 1994). These vernal pools are generally small and exhibit well-developed mima mound topography.

This unit contains large vernal pool habitat areas in the northwestern portion of the range of vernal pool fairy shrimp (criterion 1). These areas provide relatively undisturbed, hydrologically intact vernal pool habitats that will likely continue to support natural vernal pool ecosystem processes and maintain suitable habitat conditions for vernal pool fairy shrimp (criterion 4).

This unit extends from the Tehama/Glenn County border in the south, west of Ingrahm Road and east of the Black Butte Reservoir, to the vicinity of Rice Creek in the north. It also contains a Pacific Gas and Electric pipeline mitigation area established specifically for the conservation of vernal pool fairy shrimp.

Unit 11, Beale Unit, Yuba County (1,324 ac (536 ha))

This unit is adjacent to Beale AFB which contains large, relatively undisturbed vernal pool grassland habitats and an unusual diversity of vernal pool habitat types supporting vernal pool fairy shrimp (Jones and Stokes 1997b; Platenkamp 1998; CNDDB 2001; Jones and Stokes 2002). Vernal pool fairy shrimp within the area are found throughout several large vernal pool complexes of which this unit is a part. These complexes occur on four major geologic formations: the Modesto Formation, the Riverbank Formation, the Laguna Formation, and the Mehrten Formation (Platenkamp 1998). Different geologic formations provide a diversity of habitats for vernal pool fairy shrimp primarily through their effects on pool size and depth (Helm 1998; Platenkamp 1998). The unit, therefore, represents an important subsection of the ecological diversity of the species (criterion 2).

The critical habitat boundary identified in the proposed rule included a portion of Beale AFB. Since the portion of land within the base has been excluded based on the benefits of exclusion versus benefits of inclusion, this unit only covers those areas adjacent to the base which provide the necessary habitat characteristics to support the species. All the lands within this unit are privately owned. This unit is found east of Yuba City and

State Highway 65, generally south of Hammonton Road and north of South Beale Road and 6th Street adjacent to Beale AFB.

Unit 12, Western Placer County Unit (32,230 ac (13,043 ha))

The Western Placer Unit contains numerous occurrences of the species (CNDDB 2002) within functionally intact vernal pool complexes. Vernal pool fairy shrimp within this unit occur in both Northern Hardpan and Northern Volcanic Mudflow vernal pools as described by Sawyer and Keeler-Wolf (1995). This unit also supports vernal pool fairy shrimp found in vernal pools on Exchequer soils on the Mehrten geologic formation, a rare type of Northern Volcanic Mudflow vernal pool which has been reduced to only a few acres within Placer County (criterion 2). The pools are relatively short-lived and do not provide habitat for most other species of fairy shrimp (CNDDB 2002).

This unit includes a large number of conservation areas established specifically to contribute to the recovery of vernal pool fairy shrimp, and partly established through conservation efforts under section 7 of the Act. It is, therefore, more likely to maintain its occupied habitat over time (criterion 4). These protected areas include the Ahart Preserve, one of the few remaining examples of Northern Volcanic Mudflow vernal pools in the region (criterion 2), as well as the Orchard Creek Conservation Bank. This conservation bank was established for the protection of vernal pool fairy shrimp, and to compensate for the loss of thousands of acres of vernal pool grassland habitats throughout Placer and Sacramento Counties. Additional smaller conservation areas in this unit are located within the cities of Lincoln and Roseville, and in Placer County. Approximately 20 percent of all mitigation areas established for the long-term protection of vernal pool fairy shrimp are found within this unit. Placer County is currently developing a NCCP/HCP for the conservation of vernal pool fairy shrimp in this area. A WRP easement of 157 ac (63 ha) for the protection of wetland resources occurs within this unit.

The Western Placer Unit contains 70 percent of the remaining vernal pool habitats in Placer County. TNC identified this area as one of the outstanding vernal pool sites remaining in the Sacramento Valley (criterion 4). This unit generally occurs in western Placer County immediately north of the Sacramento County line, north of the City of Roseville, and northeast of the City of Rocklin. The northern boundary occurs just north of the City of Lincoln. This unit occurs mostly west of State Highway 65.

Unit 17, Napa River Unit, Napa and Sonoma Counties (1,554 ac (629 ha))

The Napa River unit represents the western extent of the species' range (criterion 1). This unit represents the only area where vernal pool fairy shrimp occur in vernal pool habitats forming a transition zone with tidal marshes (criterion 2). The boundaries of this unit were designed to include vernal pool complexes mapped by Holland (1998) and within the Fagan Marsh Ecological Area owned by CDFG (901 ac (420 ha)).

The Napa River parallels the western boundary of this unit. This unit is located on private and CDFG land, including the Napa-Sonoma Marsh and Fagan Marsh Wildlife Areas. Most of this unit is situated south and southwest of the City of Napa, primarily west of Highway 29, south of Highway 12, and east of Highway 121. This unit forms a narrow strip following the northwestern banks of the Napa River and extending westward along Hudeman and Schell sloughs.

Unit 18, San Joaquin Unit, San Joaquin County (14,343 ac (5,805 ha))

This unit contains vernal pool habitats identified by Holland (1998) and San Joaquin County (1998) that support populations of vernal pool fairy shrimp (CNDDB 2002) found within Northern Volcanic Mudflow vernal pools on the Laguna geologic formation, as well as high terrace pools on the Valley Springs geologic formation. The Northern Volcanic Mudflow vernal pools tend to be short-lived, and are a relatively rare habitat type for vernal pool fairy shrimp (criterion 2). This unit contains the largest vernal pool complex remaining in San Joaquin County and the southern Sacramento Valley (criterion 1).

This unit occupies the area from the Calaveras River south to Duck Creek. The eastern boundary extends to near Valley Springs at the intersection of State routes 12 and 26. The western boundary extends to near Tully Road east of the City of Lodi.

Unit 19A, B, and C, Altamont Hills Unit, Contra Costa, and Alameda Counties (7,902 ac (3,198 ha))

This unit contains vernal pool habitats mapped by Holland (1998) and East Bay Regional Parks District (2001) supporting vernal pool fairy shrimp occurrences identified by CNDDB (2002) within unique sandstone outcrops. These habitats include very small (less than 3.3 ft (1 m) in diameter) clear water depression pools in sandstone outcrops which provide the necessary inundation to support vernal pool fairy shrimp (Eriksen and Belk 1999). The unit represents the only known location that supports vernal pool fairy shrimp within sandstone outcrop pools (criterion 2) (Eriksen and Belk 1999).

The unit is comprised of three subunits in the general vicinity of Mount Diablo and Morgan Territory Regional Park. The unit primarily consists of private land, with 108 ac (44 ha) owned by the State, and an additional 711 ac (288 ha) administered by the CDFG for conservation purposes.

The unit lies north of Corral Hollow Road, west of Clifton Court Forebay, east of the City of Danville, southeast of Concord, and south of Antioch. It includes vernal pool habitat within the Altamont Hills, around the northern and eastern boundaries of the City of Livermore, and east of the Altamont Hills and west of Clifton Court Forebay.

Unit 21, Stanislaus Unit, Stanislaus and Merced Counties (48,599 ac (19,668 ha))

This unit contains occurrences of the species within large, relatively intact, and contiguous vernal pool complexes ranging from the floor of the valley to the low-elevation foothills (Holland 1998; CNDDB 2001). These areas are essential to the conservation of vernal pool fairy shrimp because they provide relatively undisturbed, hydrologically intact vernal pool habitats that will likely continue to support natural vernal pool ecosystem processes and maintain suitable habitat conditions for vernal pool fairy shrimp (criterion 4). This unit contains vernal pool fairy shrimp living within hardpan pools that occur on soils of alluvial fans and terraces forming numerous small pools and swales on mima mound topography. Soils supporting these vernal pools are typically older than those of the alluvial terraces in the Sacramento area.

The Stanislaus Unit is in the northern portion of the chain of vernal pools that runs through the southern Sierra Nevada foothills, within the Southern Sierra Foothill vernal pool region described by Keeler-Wolf *et al.* (1998). This vernal pool region contains 35 percent of all remaining vernal pool habitat in the Central Valley, and is extremely important to the conservation of vernal pool fairy shrimp and other vernal pool species (criterion 1 and 2). Land ownership within this unit includes the BLM (7 ha (17 ac)) and California State Parks (61 ac (25 ha). The well-known Hickman vernal pool complex is located within this unit as well as Hickman Pool, one of the largest

vernal lakes in California, at more than 300 ac (121 ha) (Medeiros 2000).

The Stanislaus Unit is located in the southeast corner of Stanislaus County and the northeast corner of Merced County. It lies between the Tuolumne River and the Merced River. The Mariposa County line is located east of the unit. Turlock Lake and Dawson Lake are adjacent to the northern boundary. County Road J9 and the High Line Canal are west of the unit.

Unit 22, Merced Unit, Merced and Mariposa Counties (111,459 ac (45,108 ha))

This unit encompasses the largest block of pristine, high density vernal pool grasslands supporting the species remaining in California (criterion 4) (Holland 1998; Vollmar 1999; CNDDB 2001). There are more documented occurrences of vernal pool fairy shrimp in this unit than any other area throughout the species range, implying it contains ecological features that are unusually supportive of vernal pool fairy shrimp populations (criterion 2) (CNDDB 2002). Almost 15 percent of all remaining vernal pool habitats in the Central Valley are located within this unit (criterion 1) (Holland 1998).

The Merced Unit is located midway in a chain of vernal pool complexes that straddles the valley floor and the foothills of the southern Sierra Nevada. Forty percent of vernal pool habitats in the Southern Sierra Foothill vernal pool region are found within this unit (criterion 1). This unit helps to maintain connectivity between vernal pool fairy shrimp habitats on the valley floor and habitats to the north and south of the Merced Unit (criterion 4).

A majority of vernal pool habitat in the Merced Unit is in Merced County. The eastern edge of the unit overlaps into Mariposa County. Bear Creek flows along the southern boundary of the unit, crossing through it in several locations. The City of Merced is south of the unit, Bear Reservoir is southeast of the unit, and the Castle Airport is located outside of the southwest boundary. The northern boundary parallels the Merced River. The entire unit is located east of Highway 99. Land ownership within the unit includes mostly private lands and approximately 8 ac (3 ha) of BLM lands. TNC has a total of 11,283 ac (4,513 ha) of conservation easements within this unit.

Unit 24B, Madera Unit, Fresno Counties (41,032 ac (16,606 ha))

The Madera Unit contains occurrences of the species living within hardpan vernal pool complexes composed of numerous small pools and swales on mima mound topography (Holland 1998; Keeler-Wolf *et al.* 1998; CNDDB 2001). These vernal pools occur on alluvial fans and terraces. South of this unit, in Fresno County, these pools become less common, because the soils that support them are less widespread (Keeler-Wolf *et al.* 1998).

Located in western Madera County, this unit is located between the Fresno River and San Joaquin River. All lands within this unit are privately owned. All vernal pools in this unit are located east of Highway 99 and the Atchison, Topeka, and Santa Fe Railroad, extending east toward the low-elevation foothill region of the Sierra Nevada. State Route 145 bisects the unit.

This unit consists of two subunits. Subunit A contains vernal pool habitats south of Millerton Lake. The western boundary of this unit is bordered by the San Joaquin River. Gordon Road cuts through the southernmost tip of the unit. Owens Mountain and Table Mountain Rancheria are located east of the Unit. The Friant Kern Canal crosses through the unit in a southeasterly direction. Subunit B is located mostly west of State Route 41 along Little Dry Creek and Cottonwood Creek.

Unit 26A, B, and C, Cross Creek Unit, Tulare and Kings Counties (7,579 ac (3,067 ha))

This unit contains vernal pools that support occurrences of the species (Holland 1998; CNDDB 2001) formed on Lewis and Youd soils (USDA 2001). This area represents the southern extent of vernal pool fairy shrimp range along the eastern margin of the Central Valley, and is the largest contiguous vernal pool habitat in this region (criteria 1 and 4) (Holland 1998; CNDDB 2001).

This unit contains CDFG's Sequoia Field and Stone Corral Ecological Reserves in Tulare County. These reserves are one of the few vernal pool conservation areas in the eastern portion of the San Joaquin Valley, and they have been the focus of several monitoring and management efforts (criterion 4). Land ownership within this unit includes 213 ac (86 ha) of CDFG lands. All other land within this unit is privately owned. TNC, Tulare County, and the Sierra Los Tulares Land Trust have identified this area as one of the best remaining examples of vernal pool habitats in the region. Much of the remaining vernal pool habitat within Tulare County has been severely degraded and converted.

This unit is comprised of three subunits. Subunit A is located in northwest Tulare County and contains vernal pool habitat located west of Seville. The Friant Kern Canal is north of the unit and the Cottonwood Creek Levee is south of the unit. Road 140 runs west of the unit. Subunit B contains vernal pools in northeastern Kings County and northwestern Tulare County. Highway 99 and St. Johns River cut through the unit in a southeasterly direction. Cross Creek and Cottonwood Creek cut through the unit in a southwesterly direction. Road 112 is east of the unit and the Lakeland Canal is west of the unit. The towns of Goshen and Visalia are south of the unit and Traver and London are north of the unit. Subunit C is known as Sequoia Field Unit and is located in northwestern Tulare County. This unit is south of County Road J36. Road 112 crosses through the western edge of the unit, Avenue 352 crosses through the southern edge, and State Route 63 crosses through the eastern edge.

Unit 27A and B, Pixley Unit, Tulare County (16,706 ac (6,761 ha))

This unit contains the largest contiguous area of habitat for the species in the southern portion of the San Joaquin Valley (criteria 1 and 4) (Holland 1998; CNDDB 2001). Vernal pool fairy shrimp in this area occur within Northern Claypan vernal pools that tend to be alkaline and larger than other vernal pool fairy shrimp habitats, such as those found on the eastern margin of the San Joaquin Valley (criterion 2).

This unit contains wintering areas for migratory waterfowl, shorebirds, marsh, and waterbirds in the southern San Joaquin Valley, and includes natural valley grasslands and developed marsh habitats within the Pixley National Wildlife Refuge complex (3,366 ac (1,362 ha)) (criterion 4). Other ownership within this unit include TNC lands (3,274 ac (1,309 ha)). All other lands within this unit are privately owned. These habitats are important for migratory waterfowl that aid in the dispersal of vernal pool fairy shrimp and other vernal pool crustacean cysts (criterion 3). This unit represents one of only three areas designated for vernal pool fairy shrimp in the San Joaquin Valley vernal pool region described by Keeler-Wolf *et al.* (1998) (criterion 1).

This unit consists of two subunits that lie south of the Cities of Hanford and Lemoore, north of the City of Wasco, and east of the City of the Tulare. In addition to vernal pool fairy shrimp, western spadefoot toad and California tiger salamander are present within this unit.

Unit 28, San Benito County Unit, San Benito and Monterey Counties (118,869 (48,125 ha))

The San Benito County Unit is located in the southwestern portion of San Benito County and the easternmost portion of Monterey County. Land ownership within this unit includes parcels that are managed by the BLM (3,906 ac (1,581 ha)) and State Land Commission (5 ac (2 ha)). All other lands within this unit are privately owned. The critical habitat unit perimeter is defined by the presence of low slope areas within watershed boundaries that are known to contain vernal pool habitats and the primary constituent elements for vernal pool fairy shrimp to occur. This unit consists of a distinct collection of ephemerally flooded wetlands west of the Great Central Valley, and overlaps a portion of the Central Coast vernal pool region that has been delineated by CDFG (Keeler-Wolf *et al.* 1998). The unit contains a minimum of 13 vernal pool complexes that are 17 to 356 ac (7 to 144 ha) in size, and includes a number of unmapped vernal pools or pool complexes that are less than 10 ac (4 ha) in size. Systematic surveys designed to determine the presence and distribution of vernal pool fairy shrimp have not been conducted for this unit. However, the habitat in the 13 vernal complexes is likely to be similar to other local habitats that are known to contain the species. Therefore, the species is probably present in many of the pools in this unit. Conservation of vernal pools in this unit is necessary to maintain and restore occurrences of vernal pool fairy shrimp that are disjunct from other listed fairy shrimp localities in the Great Central Valley (criterion 1). The need for conserving vernal pool habitats within this unit is further highlighted by the loss of eight large vernal pool complexes totaling 3,155 ac (1,276 ha) outside of the critical habitat unit in northern San Benito County between 1994 and 2000 (Holland 2003). Data from systematic surveys are not available for these areas, but the loss of such a large area of ephemeral aquatic habitat is symptomatic of the challenge currently facing the species.

Unit 29A, B, and C, Central Coastal Ranges Unit, Monterey and San Luis Obispo Counties (51,825 ac (20,974 ha))

For the sake of clarity, the Fort Hunter Liggett subunit described in the proposed rule is now the Lockwood subunit in the final rule. This reflects the removal of Fort Hunter Liggett lands from the final rule. Also, the Camp Roberts subunit in the proposed rule is now the Bradley-San Miguel subunit in the final rule. This reflects the removal of Camp Roberts lands from the final critical habitat rule.

The Central Coastal Ranges Unit includes three subunits that occur in Monterey and San Luis Obispo Counties. The three subunits include areas adjacent to the town of Lockwood, the towns of Bradley and San Miguel, and the City of Paso Robles.

The Lockwood subunit (29A) includes a single parcel that is located directly east of the Fort Hunter Liggett military base. Land ownership in the subunit is mostly private, and includes a 2–ac (1–ha) parcel managed by the BLM. Intensive surveys on Fort Hunter Liggett document the occurrence of listed fairy shrimp in a minimum of 65 pools within the base boundary (Fort Hunter Liggett 2000). The Lockwood subunit is present within one or more hydrologic units that contribute to the amount, duration, and frequency of water flow that is necessary to maintain seasonally flooded habitats that possess vernal pool fairy shrimp at Fort Hunter Liggett.

The Bradley-San Miguel subunit (29B) consists of five separate parcels that are privately owned. Four of these parcels are located immediately adjacent to the northern or eastern boundary of the Camp Roberts military base, and the fifth is immediately adjacent to the western boundary of the base. Surveys on Camp Roberts document the presence of vernal pool fairy shrimp at 61 sites (Jones and Stokes Associates 1997a). The Bradley-San Miguel subunit is present within one or more hydrologic units that contribute to the amount, duration, and frequency of water flow that is necessary to maintain seasonally flooded habitats that possess vernal pool fairy shrimp on the Camp Roberts military base.

The Paso Robles subunit (29C) consists of a polygon that is 2 to 15 mi (3.2 to 24 km) northeast of the Paso Robles city boundary. All of the land within this subunit is privately owned. Surveys along State Highway 46 document the occurrence of vernal pool fairy shrimp within the subunit (Mitch Dallas, Catrans, pers. comm.). The Paso Robles subunit possesses several large vernal pool complexes that are 105–776 ac (42–314 ha) in size. The discovery of vernal pool fairy shrimp in an area 4 mi (6 km) east of Paso Robles suggests that the species is likely to be widely dispersed in remnant vernal pools or complexes that still exist within the critical habitat subunit. The Paso Robles subunit perimeter is defined by the presence of low slope areas within watershed boundaries that are known to contain vernal pool fairy shrimp and vernal pool habitats.

The Lockwood subunit occurs within the Central Coast vernal pool region that has been delineated by the CDFG (Keeler-Wolf *et al.* 1998), and the Bradley-San Miguel and Paso Robles subunits occur within the Carrizo vernal pool region. Conservation of vernal pools in the region is necessary to stabilize and recover remnant populations of vernal pool fairy shrimp in the central coastal county area of southern California (criterion 1).

Unit 30, Carrizo Plain Unit, San Luis Obispo County (25,851 ac (10,466 ha))

This unit contains Northern Claypan vernal pools (Sawyer and Keeler-Wolf 1995) in numerous shallow alkaline depressions within a Valley Saltbush Scrub matrix. This is the only area where vernal pool fairy shrimp are known from saline salt brush scrub vernal pool habitats (criterion 2). Many vernal pools in the region are adjacent to the 3,000 ac (1,214 ha) Soda Lake, the largest alkali wetland in central and southern California, which provides a winter haven for thousands of migratory birds that provide dispersal mechanisms for the species (criterion 3). Vernal pool fairy shrimp in the Carrizo Plain Unit are located 146 mi (235 km) southeast of the closest known occurrences at Kesterson National Wildlife Refuge in Merced County, and represent an unusual geographic area (criterion 1).

The Carrizo Plain unit contains examples of native bunch grass, needle grass, and blue grass uplands which assist in maintaining the hydrology of the vernal pools and vernal pool complexes. Most of the habitat within this unit is part of the Carrizo Plain National Monument, which is administered by BLM, TNC, and CDFG for the protection of natural habitat (criterion 4). BLM lands within the unit total approximately 15,549 ac (6,293 ha) and CDFG lands total approximately 233 ac (93 ha). Other vernal pool habitats in the unit are located on private land.

This unit includes vernal pool habitat in the interior basin of the Carrizo Plain. It encompasses California Valley and Soda Lake. State Highway 58 is located north of the unit. Most of the habitat is east of Soda Lake Road; however, Soda Lake Road crosses through the western edge of the unit in several areas. To the east, the unit is bordered by the San Andreas Rift Zone.

Unit 31, Lake Cachuma Area Unit, Santa Barbara County (20,754 ac (8,399 ha))

The Lake Cachuma critical habitat unit is located within a 10 mi (16 km) radius of the northwestern portion of Lake Cachuma in central Santa Barbara County. Land ownership includes the U.S. Forest Service (USFS) (5,434 ac (2,199 ha)) and BLM (92 ac (37 ha)). All other land within the unit is privately owned. The unit boundary contains four vernal pool complexes that are at least 10 ac (4 ha) in size (Holland 2003); these complexes vary in size from 40 to 199 ac (16 to 81 ha). The unit also contains one documented occurrence of vernal pool fairy shrimp. Limited survey data for fairy shrimp exist for this unit. We believe listed fairy shrimp probably occur at several additional locations with suitable ephemeral aquatic habitat. A portion of the critical habitat unit overlaps the Santa Barbara vernal pool region delineated by the CDFG (Keeler-Wolf *et al.* 1998). The Lake Cachuma unit is essential for the conservation of vernal pool fairy shrimp because it contains seasonally flooded aquatic habitats that are located at least 36 mi (60 km) from other wetlands that are known to possess the species. Compared to most counties mentioned in this rule, Santa Barbara County contains a relatively small acreage of remaining vernal pool habitat, thereby highlighting the need to proactively manage the ephemeral aquatic habitats that still remain (criterion 1).

Unit 32, Ventura County Unit, Ventura County (46,531 ac (18,830 ha))

The Ventura County Unit is located in the north-central portion of Ventura County. With the exception of 1,951 ac (790 ha) that are privately owned, all other land within this unit occurs within the Los Padres National Forest. Vernal pool fairy shrimp and Conservancy fairy shrimp co-occur at relatively high-elevation (5,500 ft (1,700 m)) forested sites within this unit. This combination of attributes is unique because these species normally occur at much lower elevations in grassland habitat. The critical habitat perimeter encompasses an area that is known to contain vernal pool and Conservancy fairy shrimp and isolated pools that provide habitat for both species. Few fairy shrimp surveys exist for this unit. However, listed fairy shrimp probably occur at several additional locations with suitable ephemeral aquatic habitat. The Ventura County Unit is essential for the conservation of vernal pool fairy shrimp because it contains ephemeral aquatic environments that are rarely associated with fairy shrimp, and the occupied sites are disjunct from others, in that they are located at least 36 mi (60 km) from the closest known site (criteria 1 and 2).

Vernal Pool Tadpole Shrimp

Vernal pool tadpole shrimp occurrences are known from Shasta County to Tulare County, California, with an elevational variation of near 3 m (10 ft) to near 150 m (500 ft). The vernal pool types and soils associated with areas of concentration of vernal pool tadpole shrimp differ greatly across the geographic range of the species; these differences lead to different species compositions and environmental conditions between vernal pool tadpole shrimp occurrences. Providing for a mosaic of habitat types and conditions both between and among vernal pool species is essential because it would include the full extent of the physical and environmental conditions for the species (Barclay and Knight 1984; Bauder and McMillan 1998; Fugate 1992 and 1998; Gonzales *et al.* 1996, Noss *et al.* 2002a, Noss *et al.* 2002b; Platenkamp 1998; Zedler *et al.* 1979). The soils that contain occurrences of vernal pool tadpole shrimp in the delineated units vary significantly throughout the species' range. In the north, the rare Northern Mudflow formation underlies vernal pools in Shasta and Tehema Counties. Tehema and Butte Counties contain Northern Basalt Flow vernal pools that are limited to ancient terraces and hilltops that comprise some of the oldest geologic formations in California. Northern Volcanic Mudflow vernal pools are delineated in Butte and Yuba Counties. Throughout the Central Valley, the habitat ranges from high terrace landforms to claypan and hardpan pool types. Northern Basalt Flow vernal pools are found in Fresno County in the low elevation foothills. In the Suisun Marsh area, vernal pool tadpole shrimp are found in the saline-alkaline transition zone. The parent material of vernal pools greatly influences species composition and hydrologic functioning of the vernal pool (Hanes and Stromberg 1998; Holland and Jain 1981, 1988). Soils beneath vernal pools are extremely variable and are not the same as soils mapped by soil surveys, but are usually undescribed hydric inclusions which vary upon location (Holland and Dain 1990). The primary constituent elements of critical habitat for vernal pool tadpole shrimp are the habitat components that provide:

(i) Vernal pools, swales, and other ephemeral wetlands and depressions of appropriate sizes and depths that typically become inundated during winter rains and hold water for sufficient lengths of time necessary for vernal pool tadpole shrimp incubation, reproduction, dispersal, feeding, and sheltering, but which are dry during the summer and do not necessarily fill with water every year, including but not limited to, vernal pools on Redding and Corning soils on high terrace landforms, and

(ii) The geographic, topographic, and edaphic features that support aggregations or systems of hydrologically interconnected pools, swales, and other ephemeral wetlands and depressions within a matrix of surrounding uplands that together form hydrologically and ecologically functional units called vernal pool complexes. These features contribute to the filling and drying of the vernal pool and maintain suitable periods of pool inundation, water quality, and soil moisture for vernal pool crustacean hatching, growth and reproduction, and dispersal, but not necessarily every year.

Unit 1, Stillwater Plains Unit, Shasta County (3,538 ac (1,432 ha))

This unit contains the species (CNDDB 2002) within vernal pools mapped by Holland (1998) that are found on old alluvial terraces above the Sacramento River, often on Redding and Corning soil complexes (Shasta County 2001). Generally, these pools range in size from small (30 ft^2 (10 m^2)) to several acres (hectares) in size at the Stillwater Plains area. This unit is geographically important because it comprises the northern extent of the species range in California (criterion 1). The vernal pool tadpole shrimp within this unit were found to be genetically different from other populations, particularly those in the foothills of the Sierra Nevada (King 1996).

This unit is located in the area east of the Redding Municipal Airport between Airport Road to the west and Deschutes Road to the east. The unit is north of Dersch Road and south of Lassen Park Highway. This unit comprises a portion of the Stillwater Plains. This unit includes the Stillwater Plains Conservation Bank. Most of the land included within this unit is privately owned, but 130 ac (52 ha) of that is protected by WRP easements or agreements. The BLM owns 42 ac (17 ha).

Unit 2, Dales Unit, Shasta and Tehama Counties (33,975 ac (13,750 ha))

This unit is ecologically important because it is one of the few areas where vernal pool tadpole shrimp are known

to occur in Northern Mudflow vernal pools (criterion 2). Northern Mudflow vernal pools are generally small and tend to be inundated for relatively short periods of time (Keeler-Wolf *et al.* 1998). This unit contains some of the largest remaining vernal pool complexes supporting vernal pool tadpole shrimp in the northern portion of the species' range, including the Dales Plains. These areas provide relatively undisturbed, hydrologically intact vernal pool habitats that will likely continue to support natural vernal pool ecosystem processes and maintain suitable habitat conditions for vernal pool tadpole shrimp (criterion 4). The unit also provides habitat for migratory waterfowl that aid in the dispersal of vernal pool tadpole shrimp and other vernal pool crustacean cysts (criterion 3).

The Dales Unit is located in northern Tehema County. A portion of the unit overlaps into Shasta County. The vernal pool habitats west of Inskip Hill are included in this unit, as well as the area west of the Sacramento River known as Table Mountain and Table Mountain Lake. Land ownership within this unit includes BLM (14,826 ac (6,000 ha)) and State lands 709 ac (287 ha). CDFG administers approximately 42 ac (17 ha) and TNC has conservation easements on 15,575 ac (6,230 ha) within this unit. The remaining lands are privately owned.

Unit 3, Vina Plains Unit, Tehama and Butte Counties (31,195 ac (12,916 ha))

This unit is ecologically important (criterion 2) because it is one of the few areas where vernal pool tadpole shrimp are known to occur in Northern Basalt Flow vernal pools. Northern Basalt Flow vernal pools are limited to ancient terraces and hilltops that comprise some of the oldest geologic formations in California. This unit also provides habitat for migratory waterfowl that aid in the dispersal of vernal pool tadpole shrimp and other vernal pool crustacean cysts (criterion 3).

This unit is located in the northeastern portion of the Sacramento Valley, from south of Deer Creek in Tehama County to Big Chico Creek north of Chico in Butte County. The unit is geographically important (criterion 1) because it is one of only two vernal pool tadpole shrimp units within the Northeastern Sacramento Valley vernal pool region identified by CDFG (Keeler-Wolf *et al.* 1998). The unit extends south and east of the Sacramento River, paralleling the low-elevation foothill region of the Sierra Nevada. A majority of the lands included within this unit are privately owned. This unit may be more likely to support the species over time (criterion 4) because it includes protected areas such as TNC's Vina Plains preserve as well as other TNC lands 5,660 (2,264 ha) and conservation easements 10,870 ac (4,348 ha). The unit also includes 142 ac (57 ha) of private lands protected by WRP easements or agreements.

Unit 6, Dolan Unit, Colusa County (980 ac (397 ha))

This unit, like Unit 5, is noteworthy for its Northern Claypan vernal pools, as defined by Sawyer and Keeler-Wolf (1995). These vernal pools occur on alkaline soils and typically form alkali playas which are larger and contain a more diverse species composition than the hardpan pools further south (criterion 2) (Keeler-Wolf *et al.* 1998). They may display white salt deposits following pool drying.

This unit occurs east of Interstate 5, south of the City of Colusa, and west of the Colusa National Wildlife Refuge. All the lands within this unit are privately owned. This unit is primarily located on the Dolan Ranch Conservation bank.

Unit 7, Beale Unit, Yuba County (1,324 ac (536 ha))

The Beale Unit is ecologically important (criterion 2) because it contains vernal pool grasslands occurring on four major geologic formations: the Modesto Formation; the Riverbank Formation; the Laguna Formation; and the Mehrten Formation. Different geologic formations provide a diversity of habitats for vernal pool tadpole shrimp primarily through their effects on pool size and depth (Helm 1998; Platenkamp 1998). King (1996) found that vernal pool tadpole shrimp within this unit were genetically different from occurrences in other portions of the species' range, particularly those on the floor of the Central Valley. This unit is also important because it can help maintain an opportunity for long-distance dispersal of vernal pool tadpole shrimp cysts (criterion 3); the nearest unit to the north is over 28 mi (45 km) away, and the nearest unit to the south is over 40 mi (65 km) away.

The Beale Unit is located in southwestern Yuba County, south of the Yuba River and Yuba Goldfields, east of State Route 70, and north of the Bear River adjacent to Beale AFB. All the lands within this unit are privately owned.

Unit 9, Cosumnes Unit, Sacramento, Amador, and San Joaquin Counties (26,754 ac (10,827 ha))

This unit is geographically important because it contains over 30 percent of the remaining vernal pool habitats in the southern Sacramento Valley area (Holland 1998; Sacramento County 1999). It is also ecologically noteworthy (criterion 2) because it includes a diversity of pool types occupied by the species, including Northern Volcanic Mudflow vernal pools on the Mehrten and Valley Springs geologic formation overlain by Pardee and Pentz soils, vernal pools occurring on low terrace landforms associated with San Joaquin soils, and high terrace landforms associated with Redding and Corning soils (USDA 2001). This area has been identified by the Sacramento Valley Open Space Conservancy, the CNPS, and TNC as an excellent example of vernal pool grasslands, supporting a rich and diverse community of vernal pool endemic plants and animals within Sacramento County. King (1996) found that vernal pool tadpole shrimp within this unit were genetically most similar to those in Stanislaus County and nearby in Sacramento County. However, vernal pool tadpole shrimp within this unit were generally different from occurrences at other sites sampled throughout the species' range and were very different from vernal pool tadpole shrimp sampled at sites found further to the west on the floor of the Central Valley for example, at Jepson Prairie or the Kesterson Unit of the San Luis National Wildlife Refuge (King 1996).

This unit contains State and federally owned land, as well as private properties. Portions of the Cosumnes River Preserve occur within this unit. These areas provide habitat for migratory waterfowl and other avian species that aid in the dispersal of vernal pool tadpole shrimp and other vernal pool crustacean cysts (criterion 3). Several large, diverse, vernal pool landscapes are protected within this unit (criterion 4), including the Howard Ranch and Valensin Ranch. The Clay Station Mitigation Bank, Laguna Creek Mitigation Bank, and the Borden Ranch Mitigation site are included in this unit, as well as a number of smaller conservation areas, including the Rancho Seco Preserve.

This unit occupies the area south of Deer Creek and the Cosumnes River to an area just south of the Sacramento and San Joaquin County. The eastern boundary is the low-elevation foothills of western Amador County. The western limit is the Sacramento River. Land ownership and protection within the unit includes TNC (9,970 ac (3,988 ha)) lands and WRP easements (11 ac (4 ha)).

Unit 10, Davis Communications Annex Unit, Yolo County (440 ac (178 ha))

This unit is ecologically important (criterion 2) because it contains claypan vernal pools, which are generally larger and stay inundated for relatively longer periods than vernal pools on alluvial terraces or volcanic mudflows and lava flows. This unit is essential to the species because it represents some of the last remaining claypan vernal pools in Yolo County and west of the Sacramento River.

This unit is located southeast of the City of Davis and south of the South Fork of Putah Creek. This unit's western boundary coincides with the Solano and Yolo County line. The unit contains land owned by Yolo County. This unit contains DoD (1,258 ac (310 ha)) owned land.

Unit 13, Stanislaus Unit, Stanislaus County (16,323 ac (6,606 ha))

This unit contains hardpan pools on soils of alluvial fans and terraces. It is important ecologically (criterion 2) for its numerous small pools and swales on mima mound topography, supported by soils that are typically older than those of the alluvial terraces in the Sacramento area. The unit is also geographically important (criterion 1) because it contains almost 25 percent of vernal pool habitats found along the eastern margin of the San Joaquin Valley. King (1996) found that vernal pool tadpole shrimp within this unit, although similar to vernal pool tadpole shrimp in eastern Sacramento County, were genetically different from other tadpole shrimp occurrences sampled throughout the species' range, particularly those on the floor of the Central Valley. The Stanislaus Unit contains very high quality, hydrologically intact vernal pool complexes likely to persist over time (criterion 4), including the well-known Hickman pools in Stanislaus County.

The Stanislaus Unit is bordered by the Stanislaus River to the north and Dry Creek to the south and southeast in western Stanislaus County. All the land within this unit is privately owned.

Unit 14, San Francisco Bay Unit, Alameda and Santa Clara Counties (802 ac (325 ha))

This unit is geographically important (criterion 1) because it represents the only location where vernal pool tadpole shrimp occur in the San Francisco Bay region, and because it represents the western extent of the species range. The unit is over 37 mi (60 km) from the nearest unit to the north, and over 56 mi (90 km) from the nearest units to the east and south. Vernal pool tadpole shrimp within this unit are found in a unique tidal marsh estuary area that represents an unusual habitat type for the species (criterion 2).

This unit is situated south of the cities of Fremont and Newark, west of Interstate 880 and north of Mud Slough. Portions of this unit are particularly likely to persist over time (criterion 4) because they occur within the boundaries of San Francisco Bay National Wildlife Refuge. This unit also includes a preserve established as a conservation measure for vernal pool tadpole shrimp as part of the Pacific Commons development project (Service 2000b).

Unit 15, Merced Unit, Merced and Mariposa Counties (61,379 ac (24,840 ha))

This unit is important for the conservation of the species because it contains more documented occurrences of the species than any other area throughout the species' range (criterion 1) (CNDDB 2001). The Merced Unit contains almost 15 percent of all remaining vernal pool habitats in the Central Valley, and 40 percent of vernal pool habitats along the eastern margin of the San Joaquin Valley (Holland 1998). The vernal pool tadpole shrimp in this unit occur in the largest block of pristine, high-density vernal pool grasslands remaining in California (Vollmar 1999). These vernal pools support multiple large vernal pool tadpole shrimp occurrences that are capable of producing large numbers of cysts in good years, which is important for this species to survive through a variety of natural and environmental changes, as well as stochastic events (criterion 4). Genetic analyses of vernal pool tadpole shrimp revealed that occurrences in this unit are genetically different from other sampled occurrences (King 1996). Of all occurrences studied, King (1996) found these to be the most highly divergent.

A majority of the vernal pool habitat in the Merced Unit is in Merced County. The eastern edge of the unit generally follows the Mariposa County line. The Chowchilla River in Madera County flows along the southern boundary of the unit. The northern boundary parallels the Merced River. The entire unit is located east of Highway 99. As part of TNC's Merced Grasslands Project, approximately 20,288 ac (8,210 ha) of vernal pool habitat in this unit have been conserved through the establishment of conservation easements.

Unit 17, Table Mountain Unit, Fresno County (1,802 ac (729 ha))

This unit contains Northern Basalt Flow vernal pools found on narrow, sinuous basalt mesas above the surrounding low-lying terrain. Basalt flow vernal pools are a very rare habitat type for vernal pool tadpole shrimp, and the habitats within this unit are important for maintaining the range of ecological conditions in which the species occurs (criterion 2). They typically contain small, irregularly clustered pools with ''flashy hydrology'' (Keeler-Wolf *et al.* 1998). The occurrences of vernal pool tadpole shrimp in this unit are genetically different from occurrences in other portions of the species' range, particularly those occurring on the floor of the Central Valley (King 1996).

Located in Fresno County, this unit contains vernal pool habitats east and south of the San Joaquin River and east of Millerton Lake. The unit is west of Marshall Station and North of Table Mountain Rancheria. Table Mountain occurs within this unit, and land ownership within the unit includes BLM (190 ac (77 ha)), CDFG lands (419 ac (170 ha)), and TNC conservation easements (639 ac (256 ha)). All other lands within this unit are privately owned.

Unit 18A, B and C, Tulare Unit, Tulare County (7,579 ac (3,067 ha))

This unit contributes to the conservation of the species because it contains pools formed on San Joaquin, Cometa, and Madera soils, among others (criterion 2). The unit is geographically essential (criterion 1) because it represents the southern extent of the vernal pool tadpole shrimp's range. The unit is essential because it maintains the genetic diversity of the species. The Sequoia Field occurrence was most closely related to occurrences at Kesterson National Wildlife Refuge, and was generally more similar to other occurrences on the valley floor than occurrences found on the eastern margin of the valley in the Sierra Nevada Foothills. However, King (1996) found that vernal pool tadpole shrimp within this unit were genetically different from other populations studied.

This unit is comprised of three subunits located in northwest Tulare County. CDFG manages vernal pool habitats at the Stone Corral and Sequoia Field Ecological Reserves found within this unit. Keeler-Wolf *et al.* (1998) identified the vernal pools in these areas as ''high-quality hardpan pools.'' Much of the area within this unit is owned by

CDFG (212 ac (86 ha)) or occurs on private land.

Limnanthes floccosa ssp. californica

Butte County meadowfoam is found in four general areas of concentration in a narrow band from south to north of Chico, California. The vernal pool types and soils associated with the four general areas of concentration of Butte County meadowfoam include those vernal pools on Tuscan formation or terraced-alluvials with mostly Anita, Riverbank, Redbluff, Modesto, and Redding soils. The habitat associated with Butte County Meadowfoam includes saturated soils and pools with a ''flashy'' (short lived) inundation period. A vernal pool's parent material greatly influences that pool's species composition and hydrologic functioning (Hanes and Stromberg 1998; Holland and Jain 1981, 1988). Soils beneath vernal pools are extremely variable and are not the same as soils mapped by soil surveys, but are usually undescribed hydric inclusions that vary upon location (Holland and Dain 1990).

Butte County Meadowfoam is found more often within the swale system between vernal pools than in the pools themselves (Jokerst 1989). The swale habitat forms a branch or net-like pattern between the vernal pools and around mound topography and connects the vernal pools hydrologically. These swale systems are inundated by surface flow and post-storm runoff from adjacent areas and have a greater variability in environmental conditions than do the vernal pools. The swale systems also have different species compositions, depending on parent soil and moisture regime (Holland and Jain 1981, 1988; Jokerst 1989). Butte County meadowfoam at the southern extent of its range occurs on volcanic mudflows with Corning variant soils. Occurrences near Chico are on formations of eroded mudflow formations. Butte County meadowfoam in the northern extent of the species range occur on very shallow Tuscan formation soils (Dole 1988). All four areas designated as critical habitat have a different species composition, depending on soil and hydrologic conditions. We believe that providing for a mosaic of habitat types both between and among vernal pool species is essential because it would include the full extent of the physical and environmental conditions for the species (Dole 1988; Fugate 1992; Fugate 1998; Gonzales *et al.*1996; Ikeda and Schlising 1990; Noss *et al.* 2002a; Platenkamp 1998; Zedler *et al.* 1979). The primary constituent elements of critical habitat for *Limnanthes floccosa* ssp. *californica* are the habitat components that provide:

(i) Vernal pools, swales, and other ephemeral wetlands and depressions of appropriate sizes and depths and the adjacent upland margins of these depressions that sustain *Limnanthes floccosa* ssp. *californica* germination, growth and reproduction, including but not limited to vernal pool swales and the margins of vernal pools on the Tuscan, Redbluff, Riverbank, and Modesto geologic formations underlain by Tuscan-Anita and Igo-Redding complex soils, among others. These habitats typically become inundated during winter rains, but are dry during the summer and do not necessarily fill with water every year; and

(ii) The associated watershed(s) and hydrologic features, including the pool basin, swales, and surrounding uplands (which may vary in extent depending on pool size and depth, soil type and depth, hardpan or claypan type and extent, topography, and climate) that contribute to the filling and drying of the vernal pool or ephemeral wetland, and that maintain suitable periods of pool inundation, water quality, and soil moisture for *Limnanthes floccosa* ssp. *californica* germination, growth and reproduction, and dispersal, but not necessarily every year.

Unit 1, Rock Creek Unit, Butte, and Tehama Counties (15,086 ac (6,105 ha))

This unit contains the species identified by CNDDB (2002) within vernal pools on the Tuscan formation, which are ecologically noteworthy (criterion 2) because they typically contain water for shorter periods of time than other types of vernal pools. The unit is also geographically important (criterion 1) because it represents the northern extent of *Limnanthes floccosa* ssp. *californica's* range, and because it represents one of only four areas where *L. f.* ssp. *californica* occurs throughout its entire range. Each unit is likely important to allow the species to tolerate natural and environmental changes, as well as stochastic events. The unit includes occurrences from the northern race of *L. f.* ssp. *californica*. This race is genetically different from the southern race (Jokerst 1989; Dole and Sun 1992) and is important to maintain genetic diversity within the species. An introduced occurrence, thought to be of the southern race, also occurs within this unit.

This unit for *Limnanthes floccosa* ssp. *californica* occupies an area north of the City of Chico and includes vernal pool habitats east of Highway 99 along the Sierra foothills from near Pine Creek southeast to Rock Creek. All the lands within this unit are privately owned.

Lasthenia conjugens

Contra Costa goldfields occurrences are found in five centers of concentration in the northern and central Coast Range and western part of the Central Valley in Solano and Contra Costa County. By far the greatest concentration of this species is in the area east of Fairfield in Solano County. Contra Costa goldfields normally are found in vernal pools, swales, moist flats, and depressions within open grassy areas of woodland and valley grassland habitats. However, several historical collections were from populations growing in the saline-alkaline transition zone between vernal pools and tidal marshes on the eastern margin of the San Francisco Bay (CNDDB 2002).

Although some of the habitat characteristics of the species are known, specific pool characteristics that determine suitability for Contra Costa goldfields germination, growth, reproduction, and dispersal are not well understood. Contra Costa goldfields normally is observed in only a few of the pools within the vernal pool complexes in which it is found, and the pool characteristics that determine suitability for Contra Costa goldfields germination and growth are unknown. By overlapping known occurrences of Contra Costa goldfields with appropriate soil types, elevations, slopes, vegetation community associations, and vernal pool types, where we know Contra Costa goldfields to occur, we have designated what we believe is the likely distribution of the seed bank around Contra Costa goldfield occurrences. Due to the species' highly restricted nature and disjunct distribution, the long-term survival of Contra Costa goldfields depends upon the protection and management of all extant populations and their associated seed banks, and the maintenance of ecological functions within and between these populations. The primary constituent elements of critical habitat for *Lasthenia conjugens* are the habitat components that provide:

(i) Vernal pools, swales, moist flats, and other ephemeral wetlands and depressions of appropriate sizes and depths and the adjacent upland margins of these depressions that sustain *Lasthenia conjugens* germination, growth, and reproduction, including, but not limited to, vernal pools on clay soils from a variety of soils series, rock outcrop pools on basalt flows, and vernal pools in saline alkaline transition zones with tidal marsh habitats. All of these habitats typically become