

Appendix A
California Tiger Salamander and California Fairy Shrimp
Aquatic Sampling Survey Report

California Tiger Salamander and California Fairy Shrimp Aquatic Sampling Survey Report

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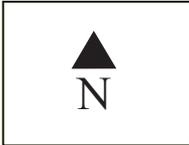
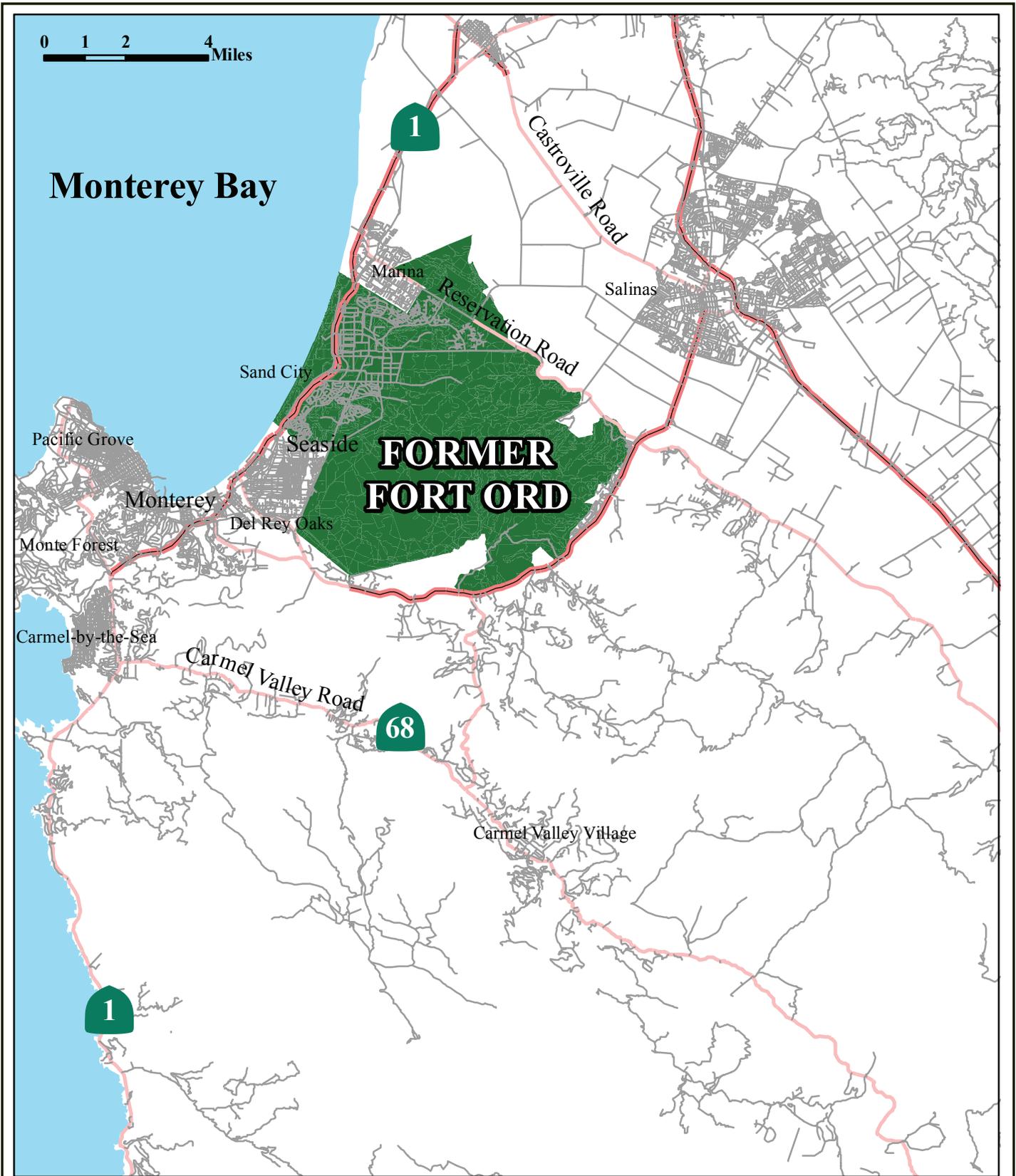
SUMMARY

The Army is required to conduct wetland monitoring surveys in any areas where environmental cleanup activities could possibly impact protected wetland species on the Former Fort Ord U.S. Army base (Fort Ord), in Monterey County, California (Figure 1). This study provides faunal baseline data for Ranges where soil remediation is likely to be performed in the near future, and could possibly have biological impacts on protected wetland species or habitat. The monitoring study is consistent with the “*Wetland Monitoring and Restoration Plan for Munitions and Contaminated Soil Remedial Activities at Former Fort Ord*” (ACOE, 2006). Faunal baseline aquatic sampling studies were conducted by Denise Duffy and Associates, Inc. (DD&A) to determine the presence/absence of the federally Threatened California tiger salamander (*Ambystoma californiense*, CTS) and invertebrates, including the California fairy shrimp (*Lindleriella occidentalis*), a federal species of special concern, at several locations within Fort Ord. Four study sites (Pools 8, 10, 21, and 30) and three control sites (Pools 5, 56, and 101 East) were identified for surveys (Figure 2). Due to the lack of sufficient ponding at three of the study pools during 2007, aquatic sampling occurred only at one of the study sites (Pool 10) and the three control sites. All four water bodies were sampled twice between January and March 2007 for invertebrates. For CTS, Pools 10 and 56 were sampled three times during the spring (once each in March, April, and May 2007); however, Pool 5 was only able to be sampled twice, and Pool 101 East once prior to drying. Methods for invertebrate sampling included using dip nets to sample representative portions of each water body to determine presence/absence of California fairy shrimp and collecting samples for branchiopod abundance counts. Methods for CTS sampling followed guidelines provided in the “*Interim guidance on site assessment and field surveys for determining presence or a negative finding of the California tiger salamander*” developed by the United States Fish and Wildlife Service (USFWS) and the California Department of Fish and Game (CDFG) in 2003.

During invertebrate sampling, California fairy shrimp were observed only at Pool 56. Other branchiopods observed were cladocerans (water fleas) at all four water bodies. Additional species observed during these sampling events were copepods, ostracods, water beetles, diving beetles, mosquito, dragonfly and damselfly larvae, mayflies, amphipods, pacific tree frog (*Hyla regilla*), waterfowl, and other birds. During CTS aquatic sampling, CTS larvae were observed only at Pool 10. Additional species observed during these sampling events were pacific tree frog, at all four water bodies, and clam shrimp (*Cyzicus sp.*), at Pools 10 and 56.

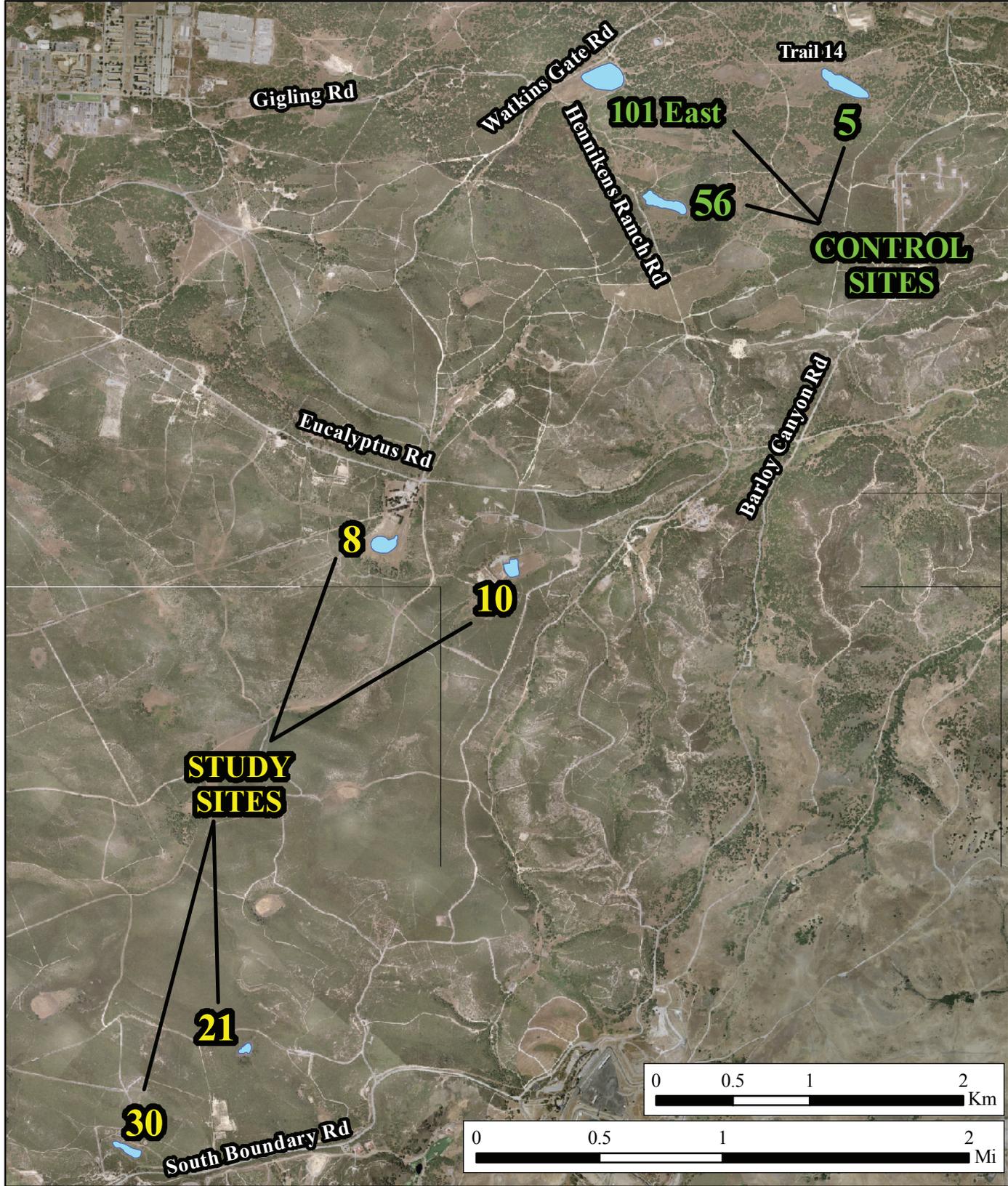
INTRODUCTION

DD&A was contracted by Shaw Environmental, Inc. (Shaw) to conduct aquatic sampling surveys for the federally Threatened CTS and California fairy shrimp, a federal species of special concern, at several locations within Fort Ord, in Monterey County, California (Figure 1). This work was conducted in support of the Shaw Total Environmental Restoration Contract (TERC) with the U. S. Department of the Army Corps of Engineers (ACOE). This report presents the results of invertebrate and protocol-level CTS aquatic sampling surveys within four study sites (Pools 8, 10, 21, and 30) and three control sites (Pools 5, 56, and 101 East).



Project Vicinity

Figure
1



Project Study and Control Sites

Figure
2

DD&A biologists were authorized to initiate aquatic sampling at the Fort Ord water bodies by the 1999 USFWS Biological Opinion on the Closure and Reuse of Fort Ord, Monterey County, California, and via project-specific written authorization from the USFWS Ventura Field Office. All initial observations of CTS larvae were reported to the USFWS Ventura Field Office via e-mail within 72 hours.

SPECIES DESCRIPTIONS

California Tiger Salamander

CTS were listed as a federally Threatened species on August 4, 2004 (69 FR 47211-47248), and are also a designated California state species of special concern. Critical Habitat was designated for CTS on August 23, 2005 (70 FR 49379-49458), and went into effect on September 22, 2005. However, Critical Habitat on Fort Ord was excluded for economic reasons.

CTS is a large, stocky salamander that inhabits grasslands and oak savanna habitats in the valleys and low hills of central and coastal California. Adults spend most of their lives underground, typically in burrows of ground squirrels and other animals (69 FR 3064-3094). During winter rains, between November and February, adults emerge from underground retreats to breed (Stebbins, 2003). Adults may travel long distances between upland sites and breeding sites, and above-ground activity may occur under suitable environmental conditions through May. During breeding migrations, individuals are sometimes found under surface objects such as rocks and logs.

CTS persist in disjunct remnant vernal pool complexes in Sonoma County and Santa Barbara County, in vernal pool complexes and isolated stocks scattered along a narrow strip of rangeland on the fringes of the Central Valley from southern Colusa County south to northern Kern County, and in sag ponds and human maintained stockponds in the coast ranges from the San Francisco Bay Area south to the Temblor Range. Tiger salamanders breed and lay eggs primarily in vernal pools and other temporary rainwater ponds following relatively warm rains in November to February. Adults have been found more than two km (1.24 miles) from breeding sites (69 FR 3064-3094). Permanent human-made ponds are sometimes utilized if predatory fishes are absent; streams are rarely used for reproduction. Males typically spend six to eight weeks at breeding ponds, while females typically spend only one to two weeks (Loredo et al., 1996). Eggs are laid singly or in clumps on both submerged and emergent vegetation and on submerged debris in shallow water (Stebbins, 1972; Jennings and Hayes, 1994). In years of below average rainfall, or when rains occur late in the season, females may forego breeding (Trehnam et al., 2000). CTS has been eliminated from an estimated 55 to 58 percent of its documented historic breeding sites. Currently, about 150 known local populations of California tiger salamanders are extant.

California Fairy Shrimp

The California fairy shrimp (*Linderiella occidentalis*) is a federal species of special concern. It was proposed for listing along with the vernal pool tadpole shrimp (*Lepidurus packardi*), vernal pool fairy shrimp (*Branchinecta lynchi*), conservancy fairy shrimp (*B. conservatio*), and longhorn fairy shrimp (*B. longiantenna*); however, the proposal was withdrawn when the other four species were listed. The Federal Register notice (59 FR 48136, September 19, 1994) states

that the USFWS “has determined that the California linderiella is not likely to become either endangered or threatened throughout all or a significant portion of its range in the foreseeable future, and it does not qualify for listing under the Act.”

The California fairy shrimp is the most common fairy shrimp in the Central Valley (USFWS, 2007). The range extends from Shasta County south to Fresno County and across the valley to the Coast and Transverse Ranges from Willits in Mendocino County south to near Sulfur Mountain in Ventura County. They are most often found in large, relatively clear vernal pools and lakes; however, they can also survive in very small pools, and/or in clear to turbid water with pH from 6.1 to 8.5 and water temperatures from 41° to 85° F.

California fairy shrimp are small (approximately 0.4 inch long) crustaceans in the Linderiellidae family of the order Anostraca. They have delicate elongate bodies; large red, stalked, compound eyes; no carapaces; and eleven pairs of swimming legs. They swim upside down, by beating their legs in a complex, wavelike movement that passes from front to back. Fairy shrimp feed on algae, bacteria, protozoa, rotifers and bits of detritus.

Female California fairy shrimp carry their eggs in a ventral brood sac, and are either dropped to the bottom of the pool or remain in the brood sac until the mother dies and sinks. When the pool dries out, so do the eggs. The resting eggs, known as cysts, are able to withstand heat, cold and prolonged desiccation. They remain in the dry pool bed until rains and other environmental stimuli hatch them. Not all of the cysts may hatch when the pools refill, but may instead remain in the soil for several years before hatching. Once hatched, the average time for fairy shrimp to reach maturity is about forty-five days. Thirty-one days is the approximate minimum time required for maturity, which is the longest minimum for any Central Valley fairy shrimp. Adults are present from late December to early May.

Suitable habitat for the California fairy shrimp has declined dramatically over the past century. The largest threat to their survival is the conversion of grassland-vernal pool ecosystems to urban or agricultural uses. In addition, California fairy shrimp populations have declined due a variety of activities that render existing vernal pools unsuitable for the species. Alteration of vernal pool hydrology, in particular, can dramatically degrade vernal pool habitats. Vernal pool hydrology can be altered by a variety of activities, including the construction of roads, trails, ditches, or canals that block the flow of water into, or drain water away from the vernal pools and vernal pool complexes. Water contamination by toxic chemicals has also caused a decline in California fairy shrimp populations due to the sensitivity of the species to the water chemistry of their habitats. In addition, California fairy shrimp habitats have declined as a result of several other incompatible land uses, including off-road vehicle use, dumping, invasion of non-native species, vandalism, erosion and sedimentation.

SITE DESCRIPTION

Fort Ord was established in 1917 as a military training base for infantry troops. In January 1991, the Secretary of Defense announced the downsizing/closure of the base. Fort Ord consists of approximately 28,000 acres near the cities of Seaside, Sand City, Monterey, Del Rey Oaks, and Marina (Figure 1). Monterey Bay marks the western boundary, Toro Regional Park borders the

base to the southeast and land use east is primarily agricultural. A variety of habitats occur within Fort Ord, including oak woodland, maritime chaparral, grasslands, riparian forest, coastal scrub, and vernal pools.

Four study sites (Pools 8, 10, 21, and 30) as well as three control sites (Pools 5, 56, and 101 East) were identified within Fort Ord boundaries for surveys. All seven of these water bodies are vernal pools and are described below in further detail:

Study Sites:

The four study sites are located in the southern and central portions of Fort Ord (Figure 2). The area surrounding these water bodies is designated for remediation of munitions and explosives of concern (MEC) and excavation of contaminated soils.

Pool 10

Pool 10 is located near the center of Fort Ord, approximately 0.03 miles south of Eucalyptus Road. When fully inundated, water covers approximately 2.5 acres. The pool is surrounded primarily by maritime chaparral with scattered coast live oak trees (*Quercus agrifolia*) and some disturbed areas. Approximately 10% of the pool's margin is occupied by emergent spikerush (*Eleocharis macrostachya*) and 2% by floating duckweed (*Lemna sp.*). During the aquatic sampling season the water was very turbid and water temperatures ranged from 53.0-67.0°F.

Pool 8

Pool 8 is located near the center of Fort Ord, south of the Bureau of Land Management (BLM) office off Eucalyptus Road. When fully inundated, water covers approximately 3.5 acres. The pool is surrounded by annual grassland, which is surrounded by maritime chaparral and oak woodland habitats. During the 2007 aquatic sampling season, no water was present in the pool.

Pool 21

Pool 21 is located in the southern portion of Fort Ord, approximately 0.04 mile north of South Boundary Road. When fully inundated, water covers approximately 1.0 acre. The pool is surrounded by annual grassland mixed with maritime chaparral that becomes denser and mixed with oak woodland further away from the pool. During the 2007 aquatic sampling season, no water was present in the pool.

Pool 30

Pool 30 is located in the southern portion of Fort Ord, less than 0.01 mile north of South Boundary Road. When fully inundated, water covers approximately 2.0 acres. The pool is surrounded by annual grassland mixed with maritime chaparral that becomes denser further away from the pool. During the 2007 aquatic sampling season, no water was present in the pool.

Control Sites:

The three control sites are located in the northern portion of Fort Ord (Figure 2) on land currently owned by the BLM. These water bodies are located in areas of Fort Ord distant enough (at least 2km) that they will not be disturbed by soil remediation or other cleanup-related work in the foreseeable future.

Pool 5

Pool 5 is located in the north eastern part of Fort Ord, south of the BLM Trail 14. The pool is fairly shallow and when fully inundated, water covers approximately 6.5 acres. It is surrounded by annual grassland and maritime chaparral habitats and emergent vegetation is dominated by spikerush and *Juncus sp.* During aquatic sampling season the water was slightly turbid and water temperatures ranged from 72.0-78.0°F.

Pool 56

Pool 56 is located in the north eastern part of Fort Ord, east of Henniken's Ranch Road. When fully inundated, water covers approximately 4.5 acres. The pool is surrounded by oak woodland, maritime chaparral, and annual grassland habitats, and many areas are highly disturbed. Emergent vegetation is dominated by spikerush and *Juncus sp.* During aquatic sampling season, the water was very clear and water temperatures ranged from 71-74.8°F.

Pool 101 East

Pool 101 East is located in the north eastern part of Fort Ord, adjacent to Watkins Gate Road. The pool is fairly shallow and when fully inundated, water covers approximately 8.5 acres. It is surrounded by annual grassland and maritime chaparral habitats and emergent vegetation is dominated by spikerush and *Juncus sp.* During aquatic sampling season, the water was slightly turbid and water temperatures ranged from 53.0-67.0°F.

METHODS

Although seven water bodies were identified for aquatic sampling, a lack of water in three of the study pools (Pools 8, 21, and 30) allowed only four water bodies (study pool 10, and control pools 5, 56, and 101 East) to be sampled during the winter and spring of 2007. Invertebrate sampling began at these four water bodies after the wetlands begin to fill with water in late January. Monitoring was conducted twice at each site between January and March 2007. For CTS, Pools 10 and 56 were sampled three times during the spring (once each in March, April, and May 2007), however Pool 5 was only able to be sampled twice, and Pool 101 East once prior to drying. Table 1 below identifies the dates of aquatic sampling events at each of these water bodies.

Table 1. Aquatic Sampling Dates

Water Body Name	Date Sampled	
	Invert.	CTS
Pool 10*	1/23/07	3/21/07
	3/6/07	4/9/07
	~~	5/7/07
Pool 5	3/6/07	3/14/07
	3/14/07	4/9/07
Pool 56	2/15/07	3/14/07
	3/6/07	4/9/07
	~~	5/7/07
Pool 101 East	3/6/07	3/14/07
	3/14/07	~~

* Pool 10 was the only study pool sampled due to lack of suitable surface water

CTS Study

DD&A biologists were authorized to conduct protocol-level CTS surveys at seven Fort Ord water bodies by the 2005 USFWS *Biological Opinion on the Cleanup and Reuse of Fort Ord as it affects California Tiger Salamander and Critical Habitat for Contra Costa Goldfields*, and via project-specific written authorization from the USFWS Ventura Field Office. Senior Environmental Biologist Josh Harwayne was the lead biologist on this project, with the assistance of Dave Keegan, and Matt Johnson of DD&A. Josh Harwayne, Dave Keegan, and Matt Johnson possess all appropriate state and federal permits to conduct CTS studies independently. Survey methods followed the “*Interim guidance on site assessment and field surveys for determining presence or a negative finding of the California tiger salamander*” developed by the USFWS and CDFG in 2003, except that aquatic sampling continued after initial detection to collect general estimates of the number of CTS larvae over time.

As much as was possible, fine-mesh seines (4’ by 10’ with 1/8” mesh) were used to capture larvae, tadpoles, and invertebrates. For deeper water bodies, the biologists would wade to a depth of three to four feet, unfurl the seine and pull it to the shore. Care was taken to pull the seine at a speed slow enough to keep the seine dragging along the bottom without collecting much sediment, but fast enough to capture mobile larvae and tadpoles. Long-handled D-shaped dip-nets (fine mesh) were frequently utilized in combination with seine nets and were particularly useful in very deep, steeply banked, and/or densely vegetated water bodies with problematic substrates (i.e., deep mud).

Samples were collected from each site until the habitat was adequately represented. Between one-half hour to two person-hours were spent seining and/or dip-netting each water body per sampling effort, depending on water body size. Sampling locations were selected to survey different portions of large water bodies. Both the shallow and deeper portions of each site were sampled to the greatest extent possible, although it was not possible to seine deeper than approximately three to four feet. Dip-nets with six-foot long handles were utilized to sample deeper portions of the water bodies as necessary.

All tadpoles and salamander larvae were easily distinguished in the field. Individuals were kept in wet nets or in Nalgene© collection boxes (containing water) for rapid identification. All animals were immediately returned to the water unharmed.

The number of CTS and other species observed at each pool was totaled and the relative abundance defined as follows:

- Few: 1 to 10 individuals;
- Common: 11 to 100 individuals; and
- Abundant: greater than 101 individuals

The length of several CTS larvae was also measured in order to track metamorphosis over time.

To reduce the possibility of spreading disease, nets and waders were scrubbed with Quat-128 solution and completely air-dried or different sets of gear were used before moving from one watershed to another. Up to four different sets of seines and dip-nets were used. At the end of

each day, all nets and waders were again treated with Quat-128 solution and completely air-dried.

Invertebrate Study

DD&A biologists were authorized to conduct aquatic surveys for California fairy shrimp at seven Fort Ord water bodies by the 1999 USFWS Biological Opinion on the Closure and Reuse of Fort Ord, Monterey County, California, and via project-specific written authorization from the USFWS Ventura Field Office. The presence/absence of California fairy shrimp and a qualitative assessment of the abundance of other vernal pool branchiopod species and invertebrates were recorded for each water body sampled. Dip nets were used to sample representative portions of each pool. Vernal pool branchiopod species detected were identified to genus with the aid of a field-magnifying lens. Samples were collected from each pool until habitat was represented. The abundance of vernal pool branchiopods was estimated by collecting 10 to 20 samples from each pool (depending on the size and complexity of each pool). The number of vernal pool branchiopods in each sample was totaled and the relative abundance defined as follows (please note that the abundance categories are consistent with previous annual monitoring reports):

- Low abundance: 1 to 10 vernal pool branchiopods;
- Moderate abundance: 11 to 100 vernal pool branchiopods;
- High abundance: 101 to 300 vernal pool branchiopods; and
- Very high abundance: more than 300 vernal pool branchiopods.

RESULTS

CTS Study

CTS were found at Pool 10 during the aquatic sampling surveys. During all three sampling events, CTS were abundant in larval form. Size ranged from 4.5-5.5 cm during the March survey. Two size classes were observed during the April survey (2-3 cm and 9-10 cm). Other species observed during surveys were Pacific tree frogs at all four water bodies and clam shrimp at Pools 10 and 56. The results of these surveys are presented below in Table 2. Please note that UC Davis biologists removed several CTS larvae from Pool 10 as part of a genetic study conducted in consultation with USFWS and the Bureau of Land Management (BLM). The number of individuals removed from the pool can be obtained from Bruce Delgado of the Fort Ord BLM office (831-394-8314).

Table 2. CTS Aquatic Sampling Results

Pond Name	Date	Time	Sampling Time (min)	# of Seines	# of Dips	Animals Captured		
						CTS	Treefrog	Clam Shrimp
Pond 10	3/21/07	9:36am	60	12	0	A	C	C
	4/9/07	2:15pm	30	6	0	A	F	A
	5/7/07	2:05pm	40	8	0	A	F	A
Pond 5	3/14/07	4:18pm	34	5	20		A	
	4/9/07	11:35am	15	0	30		A	
Pond 56	3/14/07	3:20pm	40	5	30		A	F
	4/9/07	12:38pm	35	5	20		A	A
	5/7/07	12:45pm	30	0	60		A	A
Pond 101 East	3/14/07	2:50pm	22	0	44		C	

(F = Few, C = Common, A = Abundant)

Invertebrate Study

California fairy shrimp were found at Pool 56 during the aquatic sampling surveys. Twenty-three (23) and twenty (20) individuals were observed during the February and March surveys respectively. Other branchiopods observed were cladocerans at all four water bodies. The abundance of branchiopods observed is presented below in Table 3. Additional species observed during these sampling events were copepods, ostracods, water beetles, diving beetles, mosquito, dragonfly and damselfly larvae, mayflies, amphipods, Pacific tree frog, waterfowl, and other birds. The complete results of these surveys are presented below in Table 4.

Table 3. Abundance of Branchiopods

Water Body	Date	Abundance
Pool 5	3/6/07	Very High
	3/14/07	High
Pool 10	1/23/07	Very High
	3/6/07	Very High
Pool 56	2/15/07	Very High
	3/6/07	Very High
Pool 101East	3/6/07	Very High
	3/14/07	High

Table 4. Invertebrate Aquatic Sampling Results

Species Observed				Pool 5		Pool 10		Pool 56		Pool 101 East		
Class	Order/Suborder	Family	Common Name	3/6/07	3/14/07	1/23/07	3/6/07	2/15/07	3/6/07	3/6/07	3/14/07	
BRANCHIOPODS	Anostraca		Fairy Shrimp					23	20			
	Cladocera		Water fleas	1300	250	825	785	425	530	670	150	
MAXILLOPODA	Copepoda		Copepods	X	X	X	X	X	X	X	X	
OSTRACODA			Seed shrimp	X	X	X	X	X	X	X	X	
INSECTA	Anisoptera		Dragonfly	X		X			X	X	X	
	Zygoptera		Damselfly	X		X		X	X	X		
	Coleoptera	Hydrophilidae	Water beetles							X		
		Dytiscidae	Diving beetles			X	X		X	X		
	Hemiptera	Corixidae	Water boatmen			X			X			
	Ephemeroptera		Mayflies			X		X		X		
	Diptera		Flies						X	X		
		Chaoboridae	Phantom midges			X		X				
	Culicidae	Mosquitos			X		X		X	X	X	
MALACOSTRACA	Amphipoda		Crustaceans			X	X					
AMPHIBIA			Frogs (All Hyla)			X		X	X		X	
AVES			Waterfowl			X	X				X	
			Other Birds			X	X	X	X			

CONCLUSION

DD&A was contracted by Shaw to conduct aquatic sampling surveys for California fairy shrimp and CTS at several sites located within Fort Ord in Monterey County, California. Seven water bodies (four study sites and three control sites) were identified for sampling; however, only one study site (Pool 10) and the three control sites (Pools 5, 56, and 101 East) were sampled due to insufficient ponding at the remaining three study sites. All four water bodies were sampled twice for invertebrates, including the California fairy shrimp, during the winter and spring of 2007. For CTS, Pools 10 and 56 were sampled three times during the spring of 2007; however, Pool 5 was only able to be sampled twice, and Pool 101 East once prior to drying.

California fairy shrimp were observed only in Pool 56, while CTS were observed only in Pool 10. Other branchiopods (cladocerans) were observed in all four water bodies. Other species observed during the surveys included Pacific tree frogs, clam shrimp, copepods, ostracods, water beetles, diving beetles, mosquito, dragonfly and damselfly larvae, mayflies, amphipods, waterfowl, and other birds.

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