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ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

April 8, 2010
Project No. 1002-0021

The Boeing Company
5800 Woolsey Canyon Road
Canoga Park, CA 91304

Attention: Mr. Paul Costa

Subject: Santa Susana Field Laboratory Preliminary Vernal Pool Assessment and Environmental Constraints Analysis for Special-Status Branchiopod Species

Dear Mr. Costa:

Padre Associates, Inc. (Padre) is pleased to provide The Boeing Company (Boeing) with this letter-report that documents our findings during a vernal pool assessment survey conducted for the purposes of recognizing potential habitat for listed branchiopod (fairy shrimp and tadpole shrimp) species within the Santa Susana Field Laboratory (SSFL). An assessment of several known locations of pools providing potential habitat for listed branchiopod species was conducted on March 4, 2010. These surveys were conducted for the purposes of identifying the presence of potential habitat for listed vernal pool branchiopods within the SSFL. This field survey and preliminary assessment of habitat was conducted and this letter report was prepared at your request to provide background information on these species for potential future Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) work activities. A follow-up mid-season sampling survey was conducted at these pools on March 19, 2010 after obtaining U.S. Fish and Wildlife Service (USFWS) authorization to collect fairy shrimp for the purposes of identification. A brief summary of survey and laboratory analysis results are provided below for additional background information, but a separate sampling report will be provided to Boeing (and submitted to USFWS in accordance with 10(a)(1)(A) recovery permit conditions).

Species Potentially Occurring in the Vicinity of the SSFL

Based upon a query of the California Natural Diversity Database (CNDDB), there are two known occurrences of listed fairy shrimp species in Ventura County. These include the vernal pool fairy shrimp (*Branchinecta lynchi*) and the Riverside fairy shrimp (*Streptocephalus woottonii*). In addition, there are non-listed fairy shrimp species that occur in Ventura County. A discussion of the natural history of these species is provided below.

Vernal pool fairy shrimp. The vernal pool fairy shrimp was listed as a Threatened species by the USFWS on September 19, 1994. The vernal pool fairy shrimp is a small crustacean in the Branchinectidae family. It ranges in size from one-half to one inch long. Fairy shrimp are aquatic species that occur in vernal pools or seasonally wet depressions. They have delicate

elongate bodies, large stalked compound eyes, no carapace, and eleven pairs of swimming legs. They glide gracefully upside down, swimming 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.

Range. Vernal pools were once a dominant habitat type throughout the Central Valley and provide potential habitat for a number of listed plant and animal species. The vernal pool fairy shrimp is widespread but not abundant. The known range of the vernal pool fairy shrimp extends from Shasta County through the Central Valley to Tulare County. Along the central coast, they range from northern Solano County to San Luis Obispo County. Additional populations exist outside the previously known range; these occur in Santa Barbara, Ventura, and Riverside counties.

Habitat. The habitat characteristics typical of the pools that support the vernal pool fairy shrimp include small, cool water pools, low to moderate concentrations of dissolved solids, and short and unpredictable durations (Eriksen and Belk, 1999). They most commonly occur in grass or mud bottomed swales, or basalt flow depression pools in unplowed grasslands; however, this species can occupy a variety of different habitats including small, clear, sandstone rock pools and large, turbid, alkaline, grassland valley floor pools. This species typically occurs in small pools (less than 0.05-acre) but has been collected from very large pools, including one exceeding 25 acres (USFWS, 1994).

Life History. Female fairy shrimp carry their eggs in a ventral brood sac. The fertilized eggs are dropped to the pool bottom or remain in the brood sac until the mother dies and sinks. When the pool dries out, so do the eggs. The resting eggs, also known as cysts, enter a state of suspended development (diapause) and remain in the bottom of the dry pool until rains and environmental stimuli hatch them (USFWS, 1994). Cysts are capable of withstanding heat, cold and prolonged desiccation. When the pools refill, some, but not all, of the cysts may hatch. The cyst bank in the soil may contain cysts from several years of breeding. The average time to maturity is only forty-one days. In warmer pools, it can be as little as eighteen days. The vernal pool fairy shrimp can complete its life cycle in as little as 70 days under optimal conditions with an average life span of 90 days (Eriksen and Belk, 1999).

Occurrence on Project Site. The nearest recorded occurrence of vernal pool fairy shrimp is approximately eight miles northwest of the project site at the Carlsberg vernal pools in Ventura County. There are additional known occurrences in the Los Padres National Forest and the Cruzan Mesa vernal pools in Los Angeles County. Potential habitat within the SSFL consists of small depressions in sandstone outcrops that collect rainwater and provide clear water seasonal pool habitat. The majority of the pools observed during habitat assessment surveys are small, approximately 10 to 15 square feet with the largest pool mapped at 126 square feet, and shallow. They remain inundated for a variable duration depending on the pool size and aspect as well as frequency and duration of rain events during the wet season.

Riverside fairy shrimp. The Riverside fairy shrimp was listed as a federally Endangered species by the USFWS on August 3, 1993. The Riverside fairy shrimp is a small crustacean in the Streptocephalidae family. It ranges in size from one-half to one inch long. Similar to the

vernal pool fairy shrimp described above, this is an aquatic species that occurs in vernal pools or seasonally wet habitat; however, this species is often found in habitat different from that discussed above for the vernal pool fairy shrimp. The Riverside fairy shrimp is morphologically different from the vernal pool fairy shrimp in the presence of a highly specialized antennal appendage.

Range. The Riverside fairy shrimp is rare and has the most restricted distribution of all fairy shrimp species endemic to the West Coast (Eriksen and Belk, 1999). According to the CNDDB it is only known from 25 occurrences in southern California. The Riverside fairy shrimp occurs primarily in Riverside, Orange, and San Diego counties; however, there is one recorded occurrence in Ventura County. The known range of the Riverside fairy shrimp extends from Skunk Hollow and the Santa Rosa Plateau in Riverside County to coastal occurrences in Orange and San Diego counties. Occurrences also extend south of the border into Baja California, Mexico.

Habitat. The habitat characteristics typical of the pools that support the Riverside fairy shrimp include large and long-lived, warm water pools, with very low concentrations of dissolved solids (Eriksen and Belk, 1999). They most commonly occur in grass or mud bottomed pools occurring in grasslands some of which are interspersed among chaparral or coastal sage scrub vegetation (Eriksen and Belk, 1999). These pools are typically quite large and relatively long lived, often persisting into April or May. Water may be clear, but is often moderately turbid.

Life History. The life cycle of the Riverside fairy shrimp is similar to that discussed above for the vernal pool fairy shrimp. The average time to maturity for the Riverside fairy shrimp is 48 to 56 days, with a life span of up to 150 days (Eriksen and Belk, 1999). Riverside fairy shrimp typically occur later in the season in warmer waters. Riverside fairy shrimp eggs typically hatch when the water temperature is between 10-20°C with some even hatching at 25°C (Eriksen and Belk, 1999).

Occurrence on Project Site. The nearest recorded occurrence of Riverside fairy shrimp is approximately eight miles northwest of the project site at the Carlsberg vernal pools north of the intersection of Moorpark Road and Tierra Rejada Road in Ventura County. This is the only known occurrence in Ventura County and there are no known occurrences in Los Angeles County. The small sandstone pools within the Santa Susana Field Laboratory are not the type of pools that typically support Riverside fairy shrimp; however, due to the presence of vernal pools on the SSFL property, a lack of information regarding size and type of all pools on the SSFL property, and a recorded occurrence in the vicinity, there is the possibility that they could occur within the SSFL Site.

Other Fairy Shrimp Species. In addition to the two species of listed fairy shrimp discussed in detail above, there are three species that warrant a brief discussion as to their potential for occurrence on the Boeing SSFL site. These include the versatile fairy shrimp (*Branchinecta lindahli*), San Diego fairy shrimp (*Branchinecta sandiegonensis*), and conservancy fairy shrimp (*Branchinecta conservatio*).

The versatile fairy shrimp is a non-listed fairy shrimp species that occurs in southern California and is known to occur in sandstone pools. This species occurs throughout the state of California and is also widespread outside of California. The versatile fairy shrimp is highly tolerable of variable pool conditions and water chemistry and is therefore found in many localities and in many differing seasonally wet habitats. As discussed below, the fairy shrimp collected during the March 19, 2010 surveys were determined to be versatile fairy shrimp.

The San Diego fairy shrimp is a federally endangered species occurring primarily in coastal San Diego County with several occurrences in Orange County and south of the border in Baja California, Mexico. Although this species has not been reported from Los Angeles or Ventura counties, there is one report of it at Isla Vista adjacent to the U.C. Santa Barbara campus (Eriksen and Belk, 1999). Because this report has not been re-documented, it is unknown whether the occurrence is a remnant of a former population or the result of an error in collection or identification (Eriksen and Belk, 1999). Because this unverified occurrence is north of the Boeing SSFL site, there is a very small chance that the San Diego fairy shrimp could occur in the vicinity of the site.

The conservancy fairy shrimp is a federally endangered species typically occurring in grassland pools in the northern two-thirds of the Central Valley (Eriksen and Belk, 1999). This species most commonly occurs in cool-water, moderately predictable, and long-lived pools. There is record of a highly disjunct population of conservancy fairy shrimp occurring in Ventura County. This occurrence is suspect because it is over 200 miles south of the generally recognized range of this species and because it was collected at over 5,000 feet elevation. This occurrence comes from a hatching of cysts collected in a soil sample from the reported location. No adult specimens have been collected in the field from this location and when verification of the uncharacteristic location was attempted, a wet meadow was found, but no pool was located (Eriksen and Belk, 1999). Because this population has not been further documented in the field, it is considered anectodal. Due to this anecdotal occurrence in Ventura County, there is a very small chance that the conservancy fairy shrimp could occur in the vicinity of the site; however the small sandstone pools within the SSFL are not the type of pools that typically support the conservancy fairy shrimp.

Habitat Assessment Survey Methods

A habitat survey was conducted on March 4, 2010 in which several known locations of seasonal pools were surveyed. These surveys were conducted to assess habitat quality and determine whether the pools could provide potential habitat for listed branchiopod species. Surveys were limited to two groups of known sandstone pool and chute complexes (in Area 1 and Area 4) that were inundated at the time of the surveys and did not include extensive mapping of pools throughout any portion of the SSFL. Biologists walked to areas where pools had previously been observed and recorded known pool locations using a Trimble GeoXT GPS unit capable of sub-meter accuracy. The known pool locations were overlaid onto aerial photography and are depicted on Figures 1A and 1B included under Appendix A of this letter report. Biologists observed the pools looking for the presence of fairy shrimp and noted pool size and conditions at the time of field surveys.

No dip net surveys were conducted during the March 4, 2010 field surveys due to the preliminary nature of the survey and habitat assessment. Padre biologists have the appropriate USFWS 10(a)(1)(A) Recovery permits to conduct protocol-level wet season surveys in the pools or to conduct dip-net capture and identification surveys for known fairy shrimp occurrences; however, this requires prior authorization from the USFWS to conduct such surveys. Follow-up sampling surveys were conducted on March 19, 2010 to collect and identify fairy shrimp.

Habitat Assessment Survey Results

Fairy shrimp were observed in three of the four pools mapped on one sandstone outcrop in Area 4 of the SSFL. In addition, fairy shrimp were observed in three of the five pools mapped in Area 1 of the SSFL. Surveys were not conducted site-wide or area-wide and were limited to two areas with known pool locations. It is anticipated that many more of these pool complexes are present in sandstone rock outcrop areas throughout the SSFL. Additionally, there may be other types of vernal pools present within the site. At the request of Boeing, Padre is available to conduct more extensive surveys for the purposes of mapping vernal pool complexes at the SSFL; however, it is important to note that surveys are best conducted in late winter or early spring when hydrologic conditions can be observed.

Because dip-net surveys were not conducted during the March 4, 2010 habitat assessment survey, the fairy shrimp observed were not identified to species, but based on field observations of live individuals swimming in the sandstone pools, it is likely that the fairy shrimp observed were of the genus Branchinecta; however, identification is tentative because individuals were not collected and observed under a microscope at that time.

Mid-Season Survey Methods & Results

As stated above, a follow-up mid-season survey of each pool was conducted on March 19, 2010 upon receiving authorization from USFWS to collect and identify fairy shrimp. A separate report will be prepared for submittal to the USFWS. This report will include a discussion of survey methods and results and will be provided to Boeing and the USFWS within 90 days of the survey date (as described below). However, a brief discussion and summary of the surveys and results are provided as follows:

During the mid-season collection surveys, vernal pools with known fairy shrimp occurrences were sampled. Of the nine pools mapped on Figures 2 and 3, five had dried and no longer supported aquatic organisms and thus were not included in the sampling. Photographs were taken of these pools to document their dry condition at the time of the surveys. The four pools that were still inundated were sampled to collect fairy shrimp specimens for identification. One of the four pools did not have any fairy shrimp in it at the time of the surveys. Three pools (two in Area 4 and one in Area 1) had fairy shrimp in them and voucher collections were taken at each of these pools. Additional data, including pool size, depth, water temperature, pH, and electrical conductivity were collected at each pool location. The location of the pool was recorded with a GPS and a photograph was taken to depict pool conditions at the time of sampling. Voucher specimens were fixed with preservative and taken

back to the laboratory for observation under a microscope and identification to species. All specimens collected during these surveys were determined to be the versatile fairy shrimp (*B. lindahli*) which is a non-listed species.

Recommendations

Fairy shrimp (*Branchinecta* sp.) were observed in the majority of pools visited during the initial habitat assessment survey; however, because we could not collect them it was unknown whether these individuals included listed species. Because of the occurrence of potential habitat in addition to the observation of fairy shrimp on the SSFL site, and the occurrence of listed fairy shrimp species in the vicinity of the SSFL, this taxa and their habitat should be considered and included in all biological surveys conducted within potential impact areas to avoid impact to this potentially sensitive species.

The follow-up mid-season survey resulted in the identification of versatile fairy shrimp, a non-listed species. However, the absence of listed species during one mid-season survey does not rule out its presence during some other portion of the wet season, and additional surveys would be required to determine the presence or absence of listed branchiopod species in these pools. In order to determine presence/absence of all potentially occurring vernal pool branchiopods, USFWS protocol-level surveys consisting of either two full wet season surveys or consecutive wet season and dry season surveys would be required to determine all branchiopod species occurring onsite (additional details regarding protocol-level surveys are included below).

As impact areas are surveyed within the SSFL for potential habitat (i.e. seasonal pools), protocol-level surveys would be required for any pools located within impact areas to determine if listed species are present and would be affected by the impact. A discussion of USFWS protocol-level surveys is discussed below:

Protocols require that a complete survey consisting of either (a) two full wet season surveys completed within a 5-year period; or (b) two consecutive seasons of one full wet season survey and one dry season survey be conducted within potential habitat areas to determine presence/absence of listed branchiopod species.

Wet Season Surveys. Prior to initiating wet season surveys, authorization to conduct surveys must be requested from the appropriate USFWS field office (Ventura field office). In accordance with protocols, wet season surveys must be initiated within two weeks after the pools are initially inundated to a depth of 3 cm; therefore, authorization to conduct surveys must be submitted to USFWS for approval at least one month prior to the rainy season. Upon initiation of protocol surveys, pools must be sampled once every two weeks until they are no longer inundated, or until they have experienced 120 days of continuous inundation. If pools dry and refill within the same season, sampling must be reinitiated within eight days of refilling to a depth of 3 cm, and surveys must continue until the pool has been inundated continuously for 120 days or until the pool dries completely. Once initiated, surveys may be suspended prior to completion if the presence of one or more of the listed branchiopod species is identified. Upon

completion of the wet season surveys, a 90-Day Report must be prepared and submitted to the appropriate USFWS field office no later than 90 calendar days after completion of the last field visit.

Dry Season Surveys. Dry season sampling involves collection of soils from the desiccated pools and identification of branchiopod cysts present in the soils. Dry season surveys must be conducted by someone permitted to conduct dry season surveys and only upon authorization to conduct dry season surveys at the site. Padre does not have the permits to conduct dry season surveys, but could contract a sub-consultant to complete this portion of the protocol-level surveys if necessary.

Thank you for the opportunity to work with you on this project. If you have any questions regarding the habitat assessment survey please contact me at (916) 857-1601, ext. 21.

Sincerely,

PADRE ASSOCIATES, INC.

Sarah Powell
Project Manager/Biologist

Attach: Appendix A. Aerial Views of Selected Sandstone Vernal Pools in Areas I & IV
Appendix B. Photographic Documentation

References

Eriksen, C.H., and D. Belk. 1999. *Fairy Shrimps of California's Puddles, Pools, and Playas*. Mad River Press, Eureka, CA.

U.S. Fish and Wildlife Service. 1994. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Conservancy Fairy Shrimp, Longhorn Fairy Shrimp, and the Vernal Pool Tadpole Shrimp; and Threatened Status for the Vernal Pool Fairy Shrimp. Portland, Oregon.

U.S. Fish and Wildlife Service. 1996. Interim Survey Guidelines to Permittees for Recovery Permits under Section 10(a)(1)(A) of the Endangered Species Act for the Listed Vernal Pool Branchiopods. Portland, Oregon.

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APPENDIX A. AERIAL VIEWS OF SELECTED SANDSTONE VERNAL POOLS IN AREAS I & IV

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Figure 1A
Pools Observed During Habitat Assessment in Area 4
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Figure 1B
Pools Observed During Habitat Assessment in Area 1
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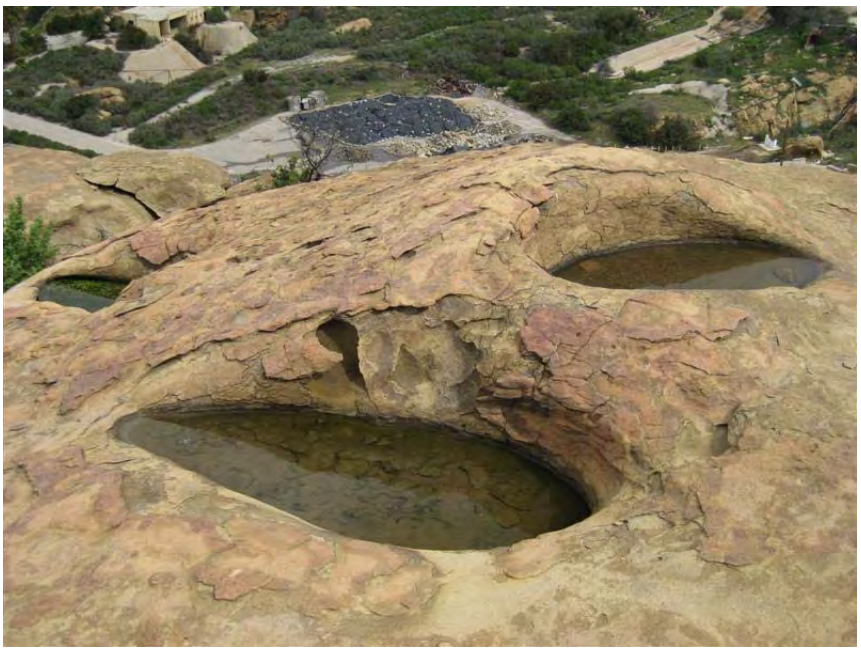
APPENDIX B. PHOTOGRAPHIC DOCUMENTATION MARCH 2010



Photograph 1. View of a cluster of three sandstone pools located in Area 1.

Photograph 2. View of the fairy shrimp observed in one of the pools in Area 1.