2023 Protocol-Level Dry-Season Sampling For The Establishment Of Baseline Biological Conditions for Federally-listed Large Branchiopods At The Clay Pit State Vehicular Recreation Area, Oroville, Butte County, California (USFWS # RP-Clay Pit-2023-1004)

Prepared for:

California Department of Parks and Recreation
715 P Street
Sacramento, CA 95820
Contact: **Shane Emerson**
(916) 539-4919

Prepared by:

Helm Biological Consulting
4600 Karchner Road
Sheridan, CA 95681
Contact: **Dr. Brent Helm**
(530) 633-0220

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HELM BIOLOGICAL CONSULTING
A Tansley Team Division
4600 Karchner Rd, Sheridan, CA 95681

2023 PROTOCOL-LEVEL DRY-SEASON SAMPLING FOR THE ESTABLISHMENT OF BASELINE BIOLOGICAL CONDITIONS FOR FEDERALLY-LISTED LARGE BRANCHIOPODS AT THE CLAY PIT STATE VEHICULAR RECREATION AREA, OROVILLE, BUTTE COUNTY, CALIFORNIA (USFWS # RP-CLAY PIT-2023-1004)

INTRODUCTION

Helm Biological Consulting (HBC), a division of Tansley Team, Inc., assisted the California Department of Parks and Recreation (hereafter "CDPR") with establishing baseline biological conditions of large branchiopods (e.g., fairy shrimp, tadpole shrimp) that are listed as threatened or endangered under the federal Endangered Species Act (e.g., the threatened vernal pool fairy shrimp [*Branchinecta lynchi*]) that occur at the Clay Pit State Vehicular Recreation Area.

The Clay Pit State Vehicular Recreation Area (hereafter "Study Area") consists of approximately 220 acres and is located immediately south of Larkin Road Southwest of the City of Oroville in Butte County, California. Additionally, the Study Area is located in an unsectionalized portion of Township 19 North, Range 3 East, and Mount Diablo Base and Meridian of the Palermo U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle map (approximate center coordinates in decimal degrees: World Geodetic System 1984 [WGS 1984] are: (39.480843, -121.678248) (Figure 1).

Background

Helm Biological Consulting (HBC) was contracted by the California Department of Parks and Recreation (Client) to assist with the development and implementation of long-term monitoring plan of large branchiopods species, in particular the federal threatened vernal pool fairy shrimp, occurring within the Study Area. This baseline data will be used to compare future cysts (embryonic eggs) estimates obtained from smaller subsamples of pools (e.g., 20 or 25% of the total number of habitats each year such that all pools onsite will be sampled within a four to five year period). This data, in conjunction with additional data proposed for collection by the CDPR staff on annual management uses and habitat changes, will be used to assess any changes in large branchiopod distributions, cysts bank population per pool, extirpations, colonizations, etc.

The remainder of this report discusses the method and results of the 2023 dry-season sampling surveys for the presence of federally-listed large branchiopods at the Study Area.

HELM
BIOLOGICAL CONSULTING
A Tansley Team Division
4600 Karchner Rd, Sheridan, CA 95681

"I certify that the information in this survey report and attached exhibits fully and accurately represents my work."

Brent P. Helm Signature ______________________ Date 9-11-2024
(TE-795930-12)

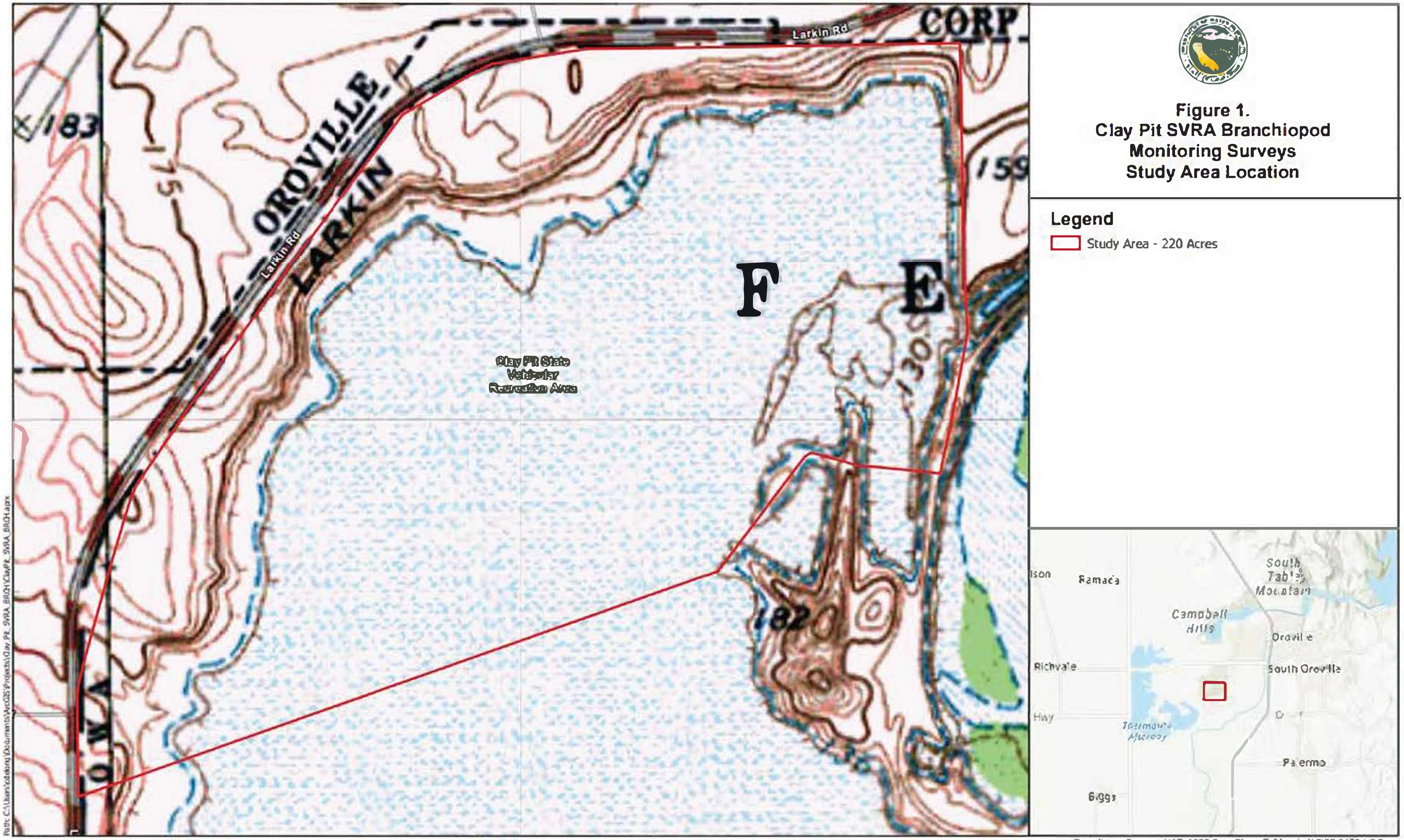

Figure 1.
Clay Pit SVRA Branchiopod Monitoring Surveys Study Area Location

Legend
Study Area - 220 Acres

USGS 7.5 Minute Quad: Palermo, CA
Latitude: 39.480843°
Longitude: -121.618248°

Scale in Feet
0 445 890

N

Coordinate System: NAD 1983 StatePlane California II FIPS 0402 US Feet
Map Preparer: Clay DeLong, CA Department of Water Resources
Map Date: 01/27/2023

METHODS

Methods followed U.S. Fish and Wildlife Service's (USFWS 2017) *Survey Guidelines for Listed Large Branchiopods* for dry-season sampling and consisted of first soil collection, second soil processing and analysis, and lastly statistical analysis as described below.

SOIL COLLECTION

Dr. Brent Helm of HBC conducted protocol dry-season sampling on October 30, 2023 as authorized by the USFWS (Appendix A) under recovery permit TE-795930-12 of Section 10(a)(1)(A) of the federal Endangered Species Act, 16 U.S.C. 1531 *et seq.,* and its implementing regulations. Dr. Helm was assisted by the following individuals:

- Becky Rozumowicz-Kodsuntie of Area West Environmental
- Claudia Rozumowicz-Kodsuntie of Area West Environmental
- Shane Emerson of California Department of Parks and Recreation
- Michelle Mah of California Department of Parks and Recreation
- Chaye Vail of California Department of Parks and Recreation
- Robin Carter-Ervin of California Department of Water Resources

Dry-season sampling was conducted in almost all of the basins (habitats) within the Study Area that had the potential to support federally-listed large branchiopods. Additionally, off-site locations adjacent to the Study Area were sampled as "Reference Pools" for comparison purposes. Basin location maps were provided by Shane Emerson.

Habitat characteristics of large branchiopods are based on the life history of Central Valley endemics (Eriksen and Belk 1999; Helm 1998, 1999; Helm and Vollmar 2002, Helm and Noyes 2016). The presence of water marks, algae mats, driftlines, hydrophytic vegetation ("water-loving plants"), slope, contributing watershed, maximum potential ponding depth, and aquatic arthropods (i.e., crustaceans and insects) exoskeletons were helpful indicators for evidence of ponding depth and duration. Habitats that swiftly flow water (e.g., creeks, streams, and ephemeral drainages), semi-to-permanently inundated areas that support a population of predators (e.g., bullfrogs, fish, and crayfish), and habitats that receive water during the dry season (i.e., artificial water sources) were not generally considered suitable habitat for federally-listed large branchiopods.

Dry-season sampling was quantitative in nature and based on USFWS (2017) protocol surveys for monitoring large branchiopod populations. A total of ten subsamples were collected from each "pool" chosen for study. Soil samples were collected along two perpendicular transects that intersect in the pool's center (deepest spot). One of the transects passed over the pool's second lowest point, resulting in four lines radiating from pool's deepest location (USFWS 2017). Two subsamples were collected along each of these four radiating lines. One sample collected at roughly 1/3 distance from the pools edge to its center and the other sample collected at roughly 2/3 distance from the pools edge to its center. The last two subsamples were collected in the deepest and second deepest portion of the pool, respectively.

All subsamples were collected with a hand trawl and consisted of a removing a thin layer of soil (1-2 cm in depth) no more than 7 cm wide and 15 cm in length. Vernal pool invertebrate cysts are typically concentrated in the upper 1-2 cm of soil (Brendonck and De Meester 2003, USFWS 2017). All 10 soil subsamples per pool will be combined into a single liter-size or 4 liter-size plastic sealable bags and marked with the project name, habitat, and date. All soil collected was dry (i.e., dry to the touch and too dry to make a ped). Representative photographs were taken of the habitats sampled (Appendix E). The soil was then transported to HBC for processing and analysis as described below.

Soil Processing and Analysis

In HBC's laboratory, the mass of each soil bag was determined with an electronic scale and recorded on standardized laboratory data form. The mass of each bag type (liter or 4 liter) was determined and subtracted from each of the soil bag mases. Initially we intended to obtain the soil volume (using a graduated cylinder) from 10 randomly selected soil bags because the soils were assumed to be uniform in texture (clay) and density since they are all mapped as 997: Pits (727356) by Natural Resource Conservation Service. However, we noticed the soil color, density, and textures varied among the bags. Therefore the color, density, and textures (hereafter "soil type") of each soil each soil bag was noted. Data on the mass of a subsamples of each soil type was obtained. The mean (average) mass in grams per soil volume (milliliter) was determined for each soil type and then used to quantify all of the soil samples collected for each soil type (Table 1).

The soil material was then processed and viewed for evidence of federally-listed large branchiopods (i.e., cysts [embryonic eggs] of fairy shrimp and tadpole shrimp) as described below.

A brine solution was prepared by mixing table salt (NaCl) with lukewarm well water in a large container. The collected soil material was placed in the brine solution. The soil material was then gently worked by hand to break down any persistent soil structure. The organic material rising to the top of the brine solution was skimmed off and placed in a 600-micron diameter pore-size sieve stacked atop a 75-micron diameter pore-size sieve. The soil material was processed through the top sieve by flushing it with lukewarm tap water while gently rubbing it with a soft-bristle brush. The soil retained from the 75-micron diameter pore size sieve was then removed and thinly (≈1.0 mm) spread into plastic petri dishes.

The contents of each petri dish were examined under a 10 to 252-power zoom binocular microscope. The number of intact cysts (embryonic eggs) was enumerated, as well as the number of broken (cracked) cysts and cysts fragments. When cysts concentrations were extreme, a proportion of the soil was viewed and cysts enumerated extrapolated back to the original amount of soil for concentration estimates of cysts. This processing method (described above) favors the detection of cysts belonging to the genera *Branchinecta*, *Lepidurus*, and *Streptocephalus* since these three genera have species that are federally listed. However, it is less precise in detecting the presence of the California fairy shrimp (*Linderiella occidentalis*) since these cysts are fragile and often lose their spines in the process, rendering their external morphology similar to several other invertebrates (e.g., copepod and hydraacarina) eggs/cysts.

Table 1. Soil Type and Mass

Soil Type	Average Soil Mass (g/ml)
Brown Clay	0.0226
Brown Fibrous	0.0089
Red Brown Clay	0.0376
Red Brown Fibrous	0.0145
Red Brown Soil	0.0598
Red Clay	0.0104
Red Clay Fibrous	0.0080
Red Fibrous	0.0495
Red Soil	0.0052
Red Tan Brown Clay	0.0111
Red Tan Brown fibrous	0.0309
Tan Brown Clay	0.0178
Tan Brown Fibrous	0.0385
Tan Brown Fibrous Clay	0.0004
Tan Brown Soil	0.0457

The presence of other aquatic macroinvertebrates encountered were noted but not quantified on the laboratory data sheets. Dr. Helm's large branchiopod cyst reference collection and scanning electron micrographs of cysts (Belk 1989, Brendock *et al*. 2008, Gilchrist 1978, Hill and Shepard 1998, Mura 1991, and Rabet 2010) were used to identify and compare any cysts observed within the soil samples.

INSTAR CULTURING

During soil processing and analysis, numerous large branchiopod cysts hatched. These hatchling were placed into individual six-quart plastic containers filled with well water (non-chlorinated) at the temperature of the water within the petri dish in which they were hatched. The containers holding the inundated soils were inserted into an environmental chamber. The environmental chamber controls were set to mimic the winter light, humidity, and temperature fluctuations of the Study Area's vicinity. The hatchlings were feed ground fish food and reared in the environmental chamber until they were mature enough to be identified using dichotomous keys and diagrams from "Fairy Shrimps of California's Puddles, Pools, and Playas" (Eriksen and Belk

1999) and two more recent publications concerning the identification of San Diego fairy shrimp (*Branchinecta sandiegonensis*) (Simovich *et al.* 2013, Patel *et al.* 2018); along with comparisons to Dr. Helm's large branchiopod reference collection.

STATISTICAL ANALYSIS

The data collected from the laboratory procedures was entered into excel spreadsheets. Descriptive statistic were performed including mean, range (minimum and maximum), and standard deviation of the mean of cyst, broken (cracked) cysts, and number of cyst fragments densities.

To analyze the potential effects of OHV use on vernal pool fairy shrimp occupancy at the Clay Pit OHV Park, resting egg (cyst) concentrations (number of cysts per ml soil) were calculated for each sample to standardize the values for each pool and remove the effect of soil sample size on the data. To calculate the volume of each soil sample, the weighed mass of each sample was multiplied by the averaged densities of each soil type. Then the number of intact and partial cysts observed was divided by this volume to calculate the intact and partial cyst concentrations in each pool.

To determine what type of statistical analyses could be used on the cyst concentration data, a Shapiro-Wilk Test was performed for the intact and partial cyst concentrations using MiniTab (v17) statistical analysis software. These tests determined that the data was not normally distributed. The data for each cyst type was then log-transformed and to prevent log-transformation errors from zero values, pools without cysts were assigned a nominal value (0.0001 cysts/ml) prior to transformation. The Shapiro-Wilk Test was run again, and the log-transformed data was normally distributed. As a result, an ANOVA was performed for the intact and partial cyst concentration datasets, using OHV-use/exposure as the treatment and OHV exclusion/isolation as the control. A test for correlation was also performed between the intact and partial cyst concentrations to determine whether the two cyst values for each pool were independent of one another.

Nonparametric tests were also performed on the un-transformed cyst concentration values, including Kruskal-Wallis tests for the intact and partial cyst concentrations. To estimate confidence intervals about the medians, Mood Median Tests were also performed in Minitab.

RESULTS

SOIL COLLECTION

Soils were collected from a total of 248 pools (basins) (Appendices B and C). A total of 178 pools were sampled within the Clay Pit (CP) Off Highway Vehicle (OHV) Park and an additional 70 pools (numbered 186 and greater) were sampled outside of the OHV Park. Two of the pools (164 and 165) occur on both the OHV Park and the adjacent offsite Rabe Road (RR) Venal Pool Management Area owned by California Department of Fish and Game. Additionally, twenty-one of the 179 pools sampled within the OHV park were fenced off from vehicular activity.

SOIL PROCESSING AND ANALYSIS

Of the 248 pools sampled, soil samples from only 12 pools did not reveal cysts belonging to the genus *Branchinecta* (Appendix D). This is roughly a 95% occupancy rate of *Branchinecta*.

INSTAR CULTURING

Four species of large branchiopod hatchlings were successfully reared to maturity: California fairy shrimp (*Linderiella occidentalis*), versatile fairy shrimp (*Branchinecta lindahli*), vernal pool fairy shrimp, and longtail tadpole shrimp (*Triops longicaudatus*).

STATISTICAL ANALYSIS

A total of 93 "Reference or Control Pools" were available to compare against 157 "Treatment Pools". Treatment pools were those that have been exposed to OHV activities; whereas, control pools fell into three categories: 1. No history of OHV use (70 pools); 2. No off OHV use within the last 6 years (21 pools); and 3. Only portions of the pool was exposed to OHV use (2 pools separated by a fence).

The ANOVA run to determine whether there was a statistical difference between the intact cyst concentrations of OHV-exposed and OHV-isolated pools found that OHV use had a significant positive effect on intact cyst concentrations. Specifically, intact cyst concentrations were roughly twice as high in OHV-exposed pools ($\bar{x}$ = 0.024 cysts/ml) compared to OVH-isolated pools ($\bar{x}$ = 0.011 cysts/ml) (p=0.003, F=9.22). However, the effect on OHV-exposure on cyst concentrations was found to be relatively week (R^2 = 3.37%). A similar trend was observed with partial cysts between OHV-exposed and OHV-isolated pools ($\bar{x}$ = 0.022 cysts/ml and $\bar{x}$ = 0.11 cysts/ml, respectively) (p=0.001, F=10.87) with OHV-exposure having a relatively weak effect on partial cyst concentrations (R^2 = 3.37%). Concentrations on intact and partial cyst concentrations in each pool were found to be highly correlated with one another (r = 0.947), suggesting that pools with high intact cyst concentrations will have similarly high concentrations of partial cysts.

Because the un-transformed cyst concentration values were typically in the hundredths (e.g., $\bar{x}$ of intact cysts in OHV-exposed pools = 0.024 cysts/ml), the magnitude of the log-transformed values were relatively high compared to the original values, ranging from -3.8 to -0.6. When confidence intervals were calculated from these log-transformed values then exponentiated (un-transformed) and expressed around the means of the un-transformed cyst concentration values, they were two degrees of magnitude greater than the means, and therefore not reflective of the ANOVA results. As a result, the confidence intervals generated from the log-transformed ANOVAs are not included in this report.

In addition to the parametric analysis, non-parametric statistical analyses were also performed to compare the cyst concentrations between the OHV-exposed and isolated pools, which compared the medians, rather than the means of the datasets, due to their non-normal distributions. When comparing intact cyst concentrations, the Kruskal-Wallis test determined that the medians between the treatment (median = 0.012 cysts/ml) and control pools (median = 0.007 cysts/ml) were significantly different, with a p-value $<<0.001$. Similarly, the partial cyst concentration medians between OHV-exposed pools (median = 0.012 cysts/ml) and isolated pools (median = 0.006 cysts/ml) were significantly different ($p<<0.001$).

Due to the presence of outliers in the data, nonparametric Mood Median Tests were also performed as an additional way to determine whether the cyst concentrations in the OHV-exposed pools were significantly higher than the isolated pool concentrations. For intact cyst concentrations, the Mood Median Test determined that the OHV-exposed pool cyst concentrations were significantly higher with a p-value of $<<0.001$ and a Chi-Square value of 12.32. As shown in Figure 2 below, the confidence intervals for the OHV-exposed (~ 0.093 cysts/ml, 0.153 cysts/ml) and isolated (~ 0.048, 0.090) pools do not overlap, confirming their significant difference.

```
                                    95.0% Confidence Intervals
Treatment  N≤  N>  Median   Q3-Q1  ----+---------+---------+---------+--
C          61  34  0.0072  0.0113  (-------*-----)
T          65  92  0.0128  0.0266                (----------*--------)
                                   ----+---------+---------+---------+--
                                     0.0060    0.0090    0.0120    0.0150
```

Figure 2. Mood Median Analysis for Intact Cysts in OHV-Exposed vs Isolated Pools

Similarly, the Mood Median Test determined that the partial cyst concentrations in the OHV-exposed pools (median = 0.011 cysts/ml) were significantly higher than the isolated pools (median = 0.007 cysts/ml) with a p-value of $<<0.001$ and a Chi-squared value of 14.21. Figure 3 illustrates the non-overlapping confidence intervals of the OHV-exposed vs isolated pools.

```
                                      95.0% Confidence Intervals
Treatment  N≤  N>   Median    Q3-Q1  ----+---------+---------+---------+--
C          62  33  0.00641  0.01099  (----*------)
T          64  93  0.01152  0.01985                (------*---------)
                                     ----+---------+---------+---------+--
                                       0.0060    0.0090    0.0120    0.0150
```

Figure 3. Mood Median Analysis for Partial Cysts in OHV-Exposed vs Isolated Pools

DISCUSSSION

Although the vernal pool fairy shrimp is known to co-occur with other large branchiopods, it is not considered a strong competitor species, as evidenced by its general preference for pools with low invertebrate and plant occupancy. In addition, it is most abundant relatively early in the wet-season, being one of the first species to hatch out when pools refill in the winter. They are also a colonizing species, both temporarily through having an active period earlier than most other invertebrates and spatially due to the various modes of dispersal of their resting eggs, which can be moved through the environment in the soil attached to livestock hooves and vehicle tires, the digestive tracts of waterfowl that consume adults (Proctor 1964, Proctor et al 1967), and wind deposition (Graham and Wirth 2008). As a result of both its habitat preferences and ability to disperse across aquatic habitats in the landscape, they are often found to inhabit areas of high disturbance, including military base tank training grounds (HBC unpublished data) and roadside ditches, in addition to the Clay Pit OHV Park. Although vehicles pose a risk to adult fairy shrimp and their eggs (Hathaway et al. 1996) through crushing, this risk appears to be outweighed by the effects that continued disturbance from OHV use has on the wetlands at the Clay Pit OHV Park through maintaining relatively low levels of vegetation cover within the pools at the park and presumably transporting resting eggs throughout the site. This trend is also evidenced by the relatively equal proportions of intact and broken cysts in the pools exposed to OHV use and those that are isolated/protected from OHV traffic. Because the versatile fairy shrimp is also present at the site, and their cysts are indistinguishable from the vernal pool fairy shrimp, future studies conducted during the wet-season to examine the spatial and temporal variation of occupancy between the two competitor species could provide further information on the effects of OHV traffic.

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APPENDIX A.
USFWS AUTHORIZATION

Gmail

Kathleen Colima Aguirre <kcolima@tansleyteam.com>

Survey Approval, RP-Clay Pit-2023-1004 , VpB

SFWO Permits, FW8 <FW8_SFWO_Permits@fws.gov> Wed, Oct 4, 2023 at 2:15 PM
To: Kathleen Colima Aguirre <kcolima@tansleyteam.com>
Cc: "Cook, Megan T" <megan_cook@fws.gov>

Kat Colima,

By this email message, you are authorized to conduct dry season vernal pool branchiopods surveys, as specified in your email correspondence with SFWO starting Oct. 3, 2023, per the conditions of your recovery permit (795930-12). Surveys will be conducted at the Clay Pit State Vehicular Recreation Area in Butte County
terms and conditions therein. This authorization does not include access to the property which must be arranged with the landowner or manager. Please let us know if the activities are not performed as authorized, or if they are done by a different permittee under a separate authorization.

Please send survey reports with the reference # RP-Clay Pit-2023-1004 to FW8_SFWO_Permits@fws.gov and the Sacramento Valley Division Supervisor, Megan Cook (megan_cook@fws.gov). Reports for vernal pool branchiopod surveys are due in 90 days. Reports for all other species are due in 45 days, unless otherwise specified in your permit. Reports should include, at minimum:

1. The reference number to help ensure that we correctly record the fulfillment of the reporting requirement under this authorization,
2. A copy of this authorization email,
3. The names of all persons involved in each activity and their recovery permit numbers, if applicable,
5. A U.S. Geological Survey topographic map (1:24,000 scale or larger scale) depicting the location of the project site, survey area, and location(s) of species in as precise a manner as possible. All other information required in the 45/90 Day Survey Report section of your permit.

Thank you,

Lauren

10(a)(1)(A) Recovery Permitting | **Sacramento Fish and Wildlife Office**

Pacific Southwest Region | U.S. Fish and Wildlife Service

Helpful Links:
ePermits
Pacific Southwest Recovery Permitting
Minimum Qualifications | Survey Protocols | Vernal Pool Branchiopod Practical Exams
We have resumed in-office vernal pool branchiopod practical exams. Please send us an email to schedule your exam.

The Sacramento Fish and Wildlife Office is using this consolidated mailbox for all communications regarding 10(a)(1)(A) recovery permits in our jurisdiction. Please send survey notifications, reports, and permit inquiries to this email address: FW8_SFWO_Permits@fws.gov.

APPENDIX B.
RESULTS OF DRY-SEASON SAMPLING

Table 2. Results of Soil Examinations

Basin No.	Surveyed (Y/N)	*Area	Control or Treatment	Soil Type	**Soil Mapping Unit	Branchinecta sp. Cysts			Lepidurus Packardi/Triops Cysts			Intact Cyst Concentration	Broken Cyst Concentration	Fragment Cyst Concentration
						Intact	Broken	Fragments	Intact	Broken	Fragments			
1	Y	CP	T	Tan Brown Clay	997-Pits	153+Instars	90	111	36+Instars	10	16	0.0567	0.0333	0.0411
2	Y	CP	T	Tan Brown Clay	997-Pits	36	28	25	0	0	0	0.0079	0.0061	0.0055
3	Y	CP	T	Tan Brown Clay	997-Pits	27+Instars	15	21	0	0	0	0.0125	0.0069	0.0097
4	Y	CP	T	Tan Brown Soil	997-Pits	42	30	56	0	0	0	0.0203	0.0145	0.0271
5	Y	CP	T	Tan Brown Clay	997-Pits	45	70	30	0	0	0	0.0055	0.0086	0.0037
6	Y	CP	T	Tan Brown Clay	997-Pits	75	78	39	0	0	0	0.0135	0.0141	0.0070
7	Y	CP	T	Tan Brown Soil	997-Pits	210+Instars	132	120	0	0	0	0.0797	0.0501	0.0456
8	Y	CP	T	Brown Clay	997-Pits	51	36	45	0	0	0	0.0226	0.0160	0.0199
9	Y	CP	C	Brown Fibrous	997-Pits	42	30	18	0	0	0	0.0026	0.0019	0.0011
10	Y	CP	T	Tan Brown Clay	997-Pits	57+Instars	69	45	0	0	0	0.0183	0.0221	0.0144
11	Y	CP	T	Tan Brown Clay	997-Pits	21	48	33	0	0	0	0.0021	0.0049	0.0034
12	Y	CP	T	Tan Brown Clay	997-Pits	33	42	30	0	0	0	0.0024	0.0030	0.0022
13	Y	CP	T	Brown Fibrous	997-Pits	52	44	28	0	0	0	0.0214	0.0181	0.0115
14	Y	CP	T	Tan Brown Fibrous	997-Pits	21	18	33	0	0	0	0.0213	0.0183	0.0335
15	Y	CP	T	Tan Brown Clay	997-Pits	60+Instars	65	35	0	0	0	0.0128	0.0139	0.0075
16	Y	CP	T	Tan Brown Clay	997-Pits	18	15	9	0	0	0	0.0106	0.0089	0.0053
17	Y	CP	T	Brown Fibrous	997-Pits	45+Instars	42	36	0	0	0	0.0053	0.0049	0.0042
18	Y	CP	T	Tan Brown Fibrous	997-Pits	210+Instars	224	130	25+Instars	35	20	0.0722	0.0770	0.0447
19	Y	CP	T	Tan Brown Clay	997-Pits	150+Instars	72	108	0	0	0	0.0416	0.0200	0.0299
20	Y	CP	T	Red Brown Fibrous	997-Pits	20	25	20	0	0	0	0.0014	0.0017	0.0014
21	Y	CP	T	Red Brown Fibrous	997-Pits	48	52	25	0	0	0	0.0122	0.0132	0.0064
22	Y	CP	T	Tan Brown Fibrous	997-Pits	94	99	63	0	0	0	0.0715	0.0753	0.0479
23	Y	CP	T	Tan Brown Clay	997-Pits	108+Instars	102	33	0	0	0	0.0698	0.0659	0.0213
24	Y	CP	T	Brown Fibrous	997-Pits	30	25	35	0	0	0	0.0084	0.0070	0.0099
25	Y	CP	T	Brown Fibrous	997-Pits	5	7	8	0	0	0	0.0029	0.0041	0.0047
26	N	CP	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
27	Y	CP	T	Tan Brown Clay	997-Pits	85	70	25	0	0	0	0.0359	0.0296	0.0106
28	Y	CP	T	Tan Brown Clay	997-Pits	72	92	68	0	0	0	0.0041	0.0053	0.0039
29	Y	CP	T	Tan Brown Clay	997-Pits	40+Instars	25	15	0	0	0	0.0073	0.0046	0.0027
30	Y	CP	T	Tan Brown Fibrous	997-Pits	84+Instars	28	48	0	0	0	0.0165	0.0055	0.0094
31	Y	CP	T	Tan Brown Clay	997-Pits	36+Instars	18	34	0	0	0	0.0040	0.0020	0.0038
32	Y	CP	T	Tan Brown Fibrous	997-Pits	36	42	21	0	0	0	0.0339	0.0395	0.0198
33	Y	CP	T	Tan Brown Soil	997-Pits	52	40	24	0	0	0	0.1599	0.1230	0.0738
34	Y	CP	T	Brown Fibrous	997-Pits	33	54	18	0	0	0	0.0089	0.0145	0.0048
35	Y	CP	T	Tan Brown Clay	997-Pits	39	35	24	9+Instars	5	6	0.0032	0.0029	0.0020
36	Y	CP	T	Brown Fibrous	997-Pits	28	32	56	0	0	0	0.0120	0.0137	0.0239
37	Y	CP	T	Brown Fibrous	997-Pits	1	5	7	0	0	0	0.0003	0.0016	0.0022
38	Y	CP	T	Brown Fibrous	997-Pits	12	16	10	0	0	0	0.0030	0.0041	0.0025
39	Y	CP	T	Red Brown Fibrous	997-Pits	44+Instars	56	32	0	0	0	0.0086	0.0110	0.0063
40	Y	CP	T	Tan Brown Clay	997-Pits	36	63	42	0	0	0	0.0113	0.0198	0.0132
41	Y	CP	T	Tan Brown Soil	997-Pits	75	100	225	0	0	0	0.1288	0.1717	0.3863
42	Y	CP	T	Tan Brown Clay	997-Pits	27+Instars	12	24	0	0	0	0.0378	0.0168	0.0336
43	Y	CP	T	Red Brown Fibrous	997-Pits	276+Instars	144	72	0	0	0	0.0504	0.0263	0.0131
44	Y	CP	T	Brown Fibrous	997-Pits	80+Instars	75	35	0	0	0	0.0098	0.0092	0.0043
45	Y	CP	C	Brown Fibrous	997-Pits	60	44	28	0	0	0	0.0050	0.0037	0.0023
46	Y	CP	C	Tan Brown Fibrous	997-Pits	36	48	16	0	0	0	0.0067	0.0090	0.0030

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Table 2. Results of Soil Examinations

Basin No.	Surveyed (Y/N)	*Area	Control or Treatment	Soil Type	**Soil Mapping Unit	Branchinecta sp. Cysts			Lepidurus Packardi/Triops Cysts			Intact Cyst Concentration	Broken Cyst Concentration	Fragment Cyst Concentration
						Intact	Broken	Fragments	Intact	Broken	Fragments			
47	Y	CP	C	Tan Brown Fibrous	997-Pits	88	56	40	0	0	0	0.0303	0.0193	0.0138
48	Y	CP	C	Tan Brown Soil	997-Pits	105+Instars	99	117	35+Instars	17	11	0.0274	0.0259	0.0306
49	Y	CP	T	Tan Brown Clay	997-Pits	42	64	46	4	3	5	0.0064	0.0098	0.0070
50	Y	CP	T	Red Tan Brown Fibrous	997-Pits	52	20	40	0	0	0	0.0309	0.0119	0.0238
51	Y	CP	T	Red Brown Fibrous	997-Pits	123	135	63	0	0	0	0.1106	0.1214	0.0567
52	Y	CP	T	Tan Brown Clay	997-Pits	60+Instars	115	50	20+Instars	10	15	0.0133	0.0254	0.0111
53	Y	CP	T	Brown Fibrous	997-Pits	132	168	84	0	0	0	0.0142	0.0181	0.0091
54	Y	CP	T	Tan Brown Clay	997-Pits	128	65	48	0	0	0	0.0199	0.0101	0.0075
55	Y	CP	C	Tan Brown Fibrous	997-Pits	104	120	64	0	0	0	0.0139	0.0160	0.0085
56	Y	CP	C	Brown Fibrous	997-Pits	40	22	14	0	0	0	0.0162	0.0089	0.0057
57	Y	CP	T	Tan Brown Clay	997-Pits	60+Instars	55	45	0	0	0	0.0027	0.0025	0.0020
58	Y	CP	C	Tan Brown Clay	997-Pits	64	48	40	0	0	0	0.0201	0.0151	0.0125
59	Y	CP	T	Tan Brown Clay	997-Pits	54	60	27	0	0	0	0.0151	0.0168	0.0076
60	Y	CP	T	Tan Brown Clay	997-Pits	39	33	21	0	0	0	0.0599	0.0506	0.0322
61	Y	CP	C	Tan Brown Clay	997-Pits	49	58	27	0	0	0	0.0121	0.0143	0.0067
62	N	CP	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
63	Y	CP	T	Tan Brown Clay	997-Pits	35	24	30	0	0	0	0.0035	0.0024	0.0030
64	Y	CP	T	Tan Brown Clay	997-Pits	124	144	68	0	0	0	0.0565	0.0656	0.0310
65	N	CP	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
66	Y	CP	T	Tan Brown Clay	997-Pits	48	55	33	0	0	0	0.0094	0.0108	0.0065
67	N	CP	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
68	Y	CP	T	Tan Brown Soil	997-Pits	55	65	35	0	0	0	0.0135	0.0160	0.0086
69	Y	CP	T	Tan Brown Clay	997-Pits	35	60	36	0	0	0	0.0022	0.0037	0.0022
70	Y	CP	T	Tan Brown Clay	997-Pits	48	52	62	0	0	0	0.0227	0.0246	0.0294
71	Y	CP	T	Tan Brown Clay	997-Pits	7	6	5	0	0	0	0.0070	0.0060	0.0050
72	Y	CP	T	Tan Brown Fibrous	997-Pits	215+Instars	225	95	0	0	0	0.0928	0.0971	0.0410
73	Y	CP	T	Tan Brown Clay	997-Pits	52	46	28	0	0	0	0.0158	0.0140	0.0085
74	Y	CP	T	Tan Brown Clay	997-Pits	66	55	32	0	0	0	0.0145	0.0120	0.0070
75	Y	CP	T	Tan Brown Fibrous	997-Pits	164	148	92	0	0	0	0.0210	0.0190	0.0118
76	Y	CP	T	Tan Brown Fibrous Clay	997-Pits	3	2	6	0	0	0	0.0004	0.0003	0.0009
77	Y	CP	T	Tan Brown Fibrous	997-Pits	96	84	52	0	0	0	0.0121	0.0106	0.0066
78	N	CP	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
79	Y	CP	T	Tan Brown Clay	997-Pits	86	105	130	0	0	0	0.0359	0.0438	0.0543
80	Y	CP	T	Tan Brown Clay	997-Pits	35	46	34	13	10	5	0.0168	0.0221	0.0163
81	Y	CP	T	Tan Brown Clay	997-Pits	76	56	48	0	0	0	0.0082	0.0060	0.0052
82	Y	CP	T	Tan Brown Clay	997-Pits	250+Instars	270	90	0	0	0	0.0407	0.0440	0.0147
83	Y	CP	T	Tan Brown Clay	997-Pits	75+Instars	90	110	24+Instars	36	21	0.0185	0.0222	0.0271
84	Y	CP	C	Brown Fibrous	997-Pits	27	39	21	0	0	0	0.0328	0.0474	0.0255
85	Y	CP	C	Tan Brown Fibrous	997-Pits	165+Instars	150	69	0	0	0	0.0933	0.0848	0.0390
86	Y	CP	T	Red Tan Brown Clay	997-Pits	40	84	44	0	0	0	0.0111	0.0233	0.0122
87	Y	CP	C	Tan Brown Soil	997-Pits	128+Instars	148	52	45+Instars	35	24	0.0116	0.0135	0.0047
88	Y	CP	C	Tan Brown Clay	997-Pits	24	28	16	0	0	0	0.0155	0.0181	0.0103
89	Y	CP	T	Tan Brown Soil	997-Pits	14	10	16	0	0	0	0.0022	0.0016	0.0025
90	Y	CP	T	Tan Brown Clay	997-Pits	60	36	33	0	0	0	0.0154	0.0092	0.0085

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Basin No.	Surveyed (Y/N)	*Area	Control or Treatment	Soil Type	**Soil Mapping Unit	Branchinecta sp. Cysts			Lepidurus Packardi/Triops Cysts			Intact Cyst Concentration	Broken Cyst Concentration	Fragment Cyst Concentration
						Intact	Broken	Fragments	Intact	Broken	Fragments			
91	Y	CP	T	Tan Brown Fibrous	997-Pits	75	45	24	0	0	0	0.0412	0.0247	0.0132
92	Y	CP	T	Tan Brown Fibrous	997-Pits	60	30	36	0	0	0	0.0163	0.0082	0.0098
93	Y	CP	T	Tan Brown Clay	997-Pits	36+Instars	59	39	0	0	0	0.0057	0.0094	0.0062
94	Y	CP	C	Tan Brown Fibrous	997-Pits	71	93	45	0	0	0	0.0349	0.0457	0.0221
95	Y	CP	T	Tan Brown Soil	997-Pits	186	215	90	0	0	0	0.0656	0.0758	0.0317
96	Y	CP	T	Tan Brown Clay	997-Pits	48	32	30	0	0	0	0.0141	0.0094	0.0088
97	Y	CP	T	Tan Brown Clay	997-Pits	68+Instars	97	45	7+Instars	5	9	0.0104	0.0149	0.0069
98	Y	CP	T	Tan Brown Clay	997-Pits	45	35	30	0	0	0	0.0152	0.0118	0.0102
99	Y	CP	T	Tan Brown Fibrous	997-Pits	23	34	15	0	0	0	0.0164	0.0242	0.0107
100	Y	CP	T	Tan Brown Fibrous	997-Pits	216+Instars	162	132	0	0	0	0.1020	0.0765	0.0624
101	Y	CP	T	Tan Brown Clay	997-Pits	110+Instars	90	40	0	0	0	0.0427	0.0349	0.0155
102	Y	CP	T	Tan Brown Fibrous	997-Pits	10	9	6	0	0	0	0.0092	0.0083	0.0055
103	Y	CP	T	Brown Fibrous	997-Pits	4	3	5	0	0	0	0.0030	0.0023	0.0038
104	Y	CP	T	Tan Brown Soil	997-Pits	192+Instars	216	96	0	0	0	0.0649	0.0731	0.0325
105	Y	CP	T	Tan Brown Clay	997-Pits	24	28	20	0	0	0	0.0130	0.0152	0.0108
106	Y	CP	T	Tan Brown Clay	997-Pits	48	54	18	0	0	0	0.0074	0.0083	0.0028
107	Y	CP	T	Tan Brown Soil	997-Pits	54	42	56	0	0	0	0.0153	0.0119	0.0159
108	Y	CP	T	Tan Brown Clay	997-Pits	78	96	42	6	6	8	0.0036	0.0045	0.0020
109	Y	CP	T	Red Brown Fibrous	997-Pits	9	5	7	0	0	0	0.0037	0.0021	0.0029
110	Y	CP	T	Brown Fibrous	997-Pits	6	9	10	0	0	0	0.0022	0.0033	0.0037
111	Y	CP	T	Tan Brown Clay	997-Pits	138+Instars	103	72	0	0	0	0.0415	0.0310	0.0217
112	Y	CP	T	Tan Brown Clay	997-Pits	60	76	88	0	0	0	0.0049	0.0063	0.0072
113	Y	CP	T	Brown Fibrous	997-Pits	90+Instars	114	35	0	0	0	0.0553	0.0701	0.0215
114	Y	CP	T	Tan Brown Clay	997-Pits	25	35	20	0	0	0	0.0047	0.0065	0.0037
115	Y	CP	T	Tan Brown Clay	997-Pits	85+Instars	65	55	0	0	0	0.0090	0.0069	0.0058
116	Y	CP	T	Tan Brown Clay	997-Pits	115+Instars	95	65	0	0	0	0.0457	0.0378	0.0258
117	Y	CP	T	Brown Fibrous	997-Pits	20	16	48	0	0	0	0.0079	0.0064	0.0191
118	Y	CP	T	Tan Brown Fibrous	997-Pits	210+Instars	154	78	0	0	0	0.0918	0.0673	0.0341
119	Y	CP	T	Brown Fibrous	997-Pits	33	51	39	0	0	0	0.0021	0.0032	0.0025
120	Y	CP	T	Tan Brown Fibrous	997-Pits	25	15	5	0	0	0	0.0318	0.0191	0.0064
121	Y	CP	T	Red Brown Soil	997-Pits	64	60	28	0	0	0	0.0269	0.0252	0.0118
122	Y	CP	T	Tan Brown Clay	997-Pits	75+Instars	69	39	0	0	0	0.0329	0.0303	0.0171
123	Y	CP	T	Tan Brown Fibrous	997-Pits	39	35	21	0	0	0	0.0203	0.0234	0.0109
124	Y	CP	T	Brown Fibrous	997-Pits	78+Instars	36	42	0	0	0	0.0237	0.0109	0.0128
125	Y	CP	T	Red Brown Clay	997-Pits	88+Instars	76	32	0	0	0	0.0698	0.0603	0.0254
126	Y	CP	T	Tan Brown Soil	997-Pits	34	46	22	0	0	0	0.0104	0.0141	0.0067
127	Y	CP	T	Tan Brown Clay	997-Pits	64	72	20	0	0	0	0.0240	0.0270	0.0075
128	Y	CP	T	Tan Brown Clay	997-Pits	47	28	25	0	0	0	0.0077	0.0046	0.0041
129	Y	CP	T	Tan Brown Clay	997-Pits	160	75	66	0	0	0	0.0319	0.0149	0.0131
130	Y	CP	T	Tan Brown Clay	997-Pits	105	90	51	0	0	0	0.0337	0.0288	0.0163
131	Y	CP	T	Tan Brown Clay	997-Pits	104	112	72	0	0	0	0.0062	0.0067	0.0043
132	Y	CP	T	Red Brown Fibrous	997-Pits	60	44	52	0	0	0	0.0108	0.0080	0.0094
133	Y	CP	T	Brown Fibrous	997-Pits	21	18	24	0	0	0	0.0035	0.0030	0.0039
134	Y	CP	T	Red Clay	997-Pits	42	33	15	0	0	0	0.0265	0.0208	0.0095
135	Y	CP	T	Tan Brown Clay	997-Pits	1	2	5	0	0	0	0.0001	0.0003	0.0007
136	Y	CP	T	Tan Brown Clay	997-Pits	23	14	11	2+Instars	2	0	0.0022	0.0014	0.0011

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						Intact	Broken	Fragments	Intact	Broken	Fragments			
137	Y	CP	C	Brown Fibrous	997-Pits	6	9	12	0	0	0	0.0038	0.0057	0.0075
138	Y	CP	T	Red Clay Fibrous	997-Pits	0	0	0	0	0	0	0.0000	0.0000	0.0000
139	Y	CP	T	Red Brown Fibrous	997-Pits	7	4	5	0	0	0	0.0039	0.0023	0.0028
140	Y	CP	T	Red Fibrous	997-Pits	270+Instars	168	84	0	0	0	0.0927	0.0577	0.0288
141	Y	CP	T	Red Clay	997-Pits	18	19	8	0	0	0	0.0027	0.0029	0.0012
142	Y	CP	T	Red Brown Fibrous	997-Pits	15	11	8	0	0	0	0.0027	0.0020	0.0014
143	Y	CP	T	Red Brown Fibrous	997-Pits	33	18	15	0	0	0	0.0073	0.0040	0.0033
144	Y	CP	T	Red Clay	997-Pits	27	39	21	0	0	0	0.0080	0.0115	0.0062
145	Y	CP	T	Red Clay	997-Pits	5	4	2	0	0	0	0.0008	0.0007	0.0003
146	Y	CP	T	Red Clay	997-Pits	63	69	36	0	0	0	0.0095	0.0104	0.0054
147	Y	CP	T	Red Clay	997-Pits	40	24	36	0	0	0	0.0103	0.0062	0.0092
148	Y	CP	T	Red Clay	997-Pits	15	30	27	0	0	0	0.0087	0.0174	0.0157
149	Y	CP	T	Red Clay	997-Pits	27	16	24	0	0	0	0.0059	0.0035	0.0052
150	Y	CP	T	Red Fibrous	997-Pits	40+Instars	10	15	0	0	0	0.0414	0.0103	0.0155
151	Y	CP	C	Red Brown Fibrous	997-Pits	0	0	0	0	0	0	0.0000	0.0000	0.0000
152	Y	CP	T	Red Brown Fibrous	997-Pits	0	0	0	0	0	0	0.0000	0.0000	0.0000
153	Y	CP	T	Red Clay	997-Pits	4	2	7	0	0	0	0.0009	0.0005	0.0016
154	Y	CP	T	Red Fibrous	997-Pits	39	21	36	0	0	0	0.0624	0.0336	0.0576
155	Y	CP	T	Red Clay	997-Pits	12	10	54	0	0	0	0.0060	0.0050	0.0269
156	Y	CP	T	Red Clay Fibrous	997-Pits	33	12	21	0	0	0	0.0226	0.0082	0.0144
157	Y	CP	T	Red Soil	997-Pits	5	4	6	0	0	0	0.0052	0.0042	0.0062
158	Y	CP	T	Red Clay	997-Pits	16	12	36	0	0	0	0.0070	0.0053	0.0158
159	Y	CP	T	Red Clay	997-Pits	52+Instars	64	24	0	0	0	0.0475	0.0585	0.0219
160	Y	CP	T	Red Clay Fibrous	997-Pits	3	2	7	0	0	0	0.0015	0.0010	0.0035
161	Y	CP	T	Red Clay	997-Pits	3	5	6	0	0	0	0.0008	0.0013	0.0016
162	Y	CP	T	Brown Fibrous	997-Pits	0	0	0	0	0	0	0.0000	0.0000	0.0000
163	Y	CP	T	Brown Fibrous	997-Pits	21	39	30	0	0	0	0.0061	0.0113	0.0087
164	Y	CP	M	Tan Brown Clay	997-Pits	15	10	15	0	0	0	0.0021	0.0014	0.0018
165	Y	CP	M	Tan Brown Soil	997-Pits	80	63	45	0	0	0	0.0424	0.0316	0.0244
166	Y	CP	T	Tan Brown Clay	997-Pits	45	40	54	0	0	0	0.0140	0.0124	0.0168
167	Y	CP	T	Tan Brown Clay	997-Pits	65	30	15	0	0	0	0.0218	0.0100	0.0050
168	Y	CP	T	Tan Brown Clay	997-Pits	105	90	45	0	0	0	0.0192	0.0165	0.0082
169	Y	CP	T	Tan Brown Soil	997-Pits	66+Instars	36	30	0	0	0	0.0348	0.0190	0.0158
170	Y	CP	T	Red Brown Fibrous	997-Pits	245+Instars	150	95	0	0	0	0.0043	0.0026	0.0016
171	Y	CP	T	Red Brown Soil	997-Pits	200+Instars	150	90	0	0	0	0.0863	0.0647	0.0388
172	Y	CP	T	Tan Brown Clay	997-Pits	18	22	20	0	0	0	0.0026	0.0032	0.0029
173	Y	CP	T	Tan Brown Clay	997-Pits	52+Instars	40	28	0	0	0	0.0274	0.0211	0.0148
174	Y	CP	T	Red Brown Soil	997-Pits	325+Instars	255	125	0	0	0	0.2162	0.1696	0.0832
175	Y	CP	T	Red Brown Fibrous	997-Pits	138	132	69	0	0	0	0.0216	0.0207	0.0108
176	Y	CP	T	Tan Brown Soil	997-Pits	60	35	25	0	0	0	0.0078	0.0045	0.0032
177	N	CP	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
178	Y	CP	T	Tan Brown Clay	997-Pits	40	65	26	0	0	0	0.0016	0.0026	0.0011
179	Y	CP	T	Tan Brown Clay	997-Pits	95+Instars	85	50	0	0	0	0.0311	0.0278	0.0164
180	N	CP	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
181	Y	CP	C	Brown Fibrous	997-Pits	158	200	86	0	0	0	0.0449	0.0595	0.0257
182	Y	CP	C	Brown Fibrous	997-Pits	81	96	66	0	0	0	0.0090	0.0106	0.0073

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Basin No.	Surveyed (Y/N)	*Area	Control or Treatment	Soil Type	**Soil Mapping Unit	Branchinecta sp. Cysts			Lepidurus Packardi/Triops Cysts			Intact Cyst Concentration	Broken Cyst Concentration	Fragment Cyst Concentration
						Intact	Broken	Fragments	Intact	Broken	Fragments			
183	Y	CP	C	Tan Brown Soil	997-Pits	60	65	85	18	2	6	0.0091	0.0099	0.0130
184	Y	CP	C	Brown Fibrous	997-Pits	126	153	135	0	0	0	0.0117	0.0142	0.0125
185	Y	CP	C	Tan Brown Fibrous	997-Pits	55+Instars	40	60	0	0	0	0.0105	0.0077	0.0115
186	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
187	Y	RR	C	Brown Fibrous	997-Pits	4	2	9	0	0	0	0.0015	0.0007	0.0033
188	Y	RR	C	Brown Fibrous	997-Pits	9	6	5	0	0	0	0.0022	0.0014	0.0012
189	Y	RR	C	Brown Fibrous	997-Pits	0	0	0	0	0	0	0.0000	0.0000	0.0000
190	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
191	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
192	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
193	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
194	Y	RR	C	Brown Fibrous	997-Pits	0	0	0	0	0	0	0.0000	0.0000	0.0000
195	Y	RR	C	Brown Fibrous	997-Pits	1	2	8	0	0	0	0.0003	0.0006	0.0023
196	Y	RR	C	Brown Fibrous	997-Pits	4	3	9	0	0	0	0.0010	0.0008	0.0024
197	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
198	Y	RR	C	Red Brown Soil	997-Pits	35	20	55	0	0	0	0.0149	0.0085	0.0234
199	Y	RR	C	Brown Fibrous	997-Pits	28	40	36	0	0	0	0.0033	0.0046	0.0042
200	Y	RR	C	Brown Fibrous	997-Pits	15	24	36	0	0	0	0.0020	0.0032	0.0048
201	Y	RR	C	Brown Fibrous	997-Pits	30	24	9	0	0	0	0.0094	0.0075	0.0028
202	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
203	Y	RR	C	Brown Fibrous	997-Pits	48	39	36	0	0	0	0.0048	0.0039	0.0036
204	Y	RR	C	Brown Fibrous	997-Pits	92	68	52	0	0	0	0.0063	0.0047	0.0036
205	Y	RR	C	Brown Fibrous	997-Pits	76+Instars	48	39	0	0	0	0.0088	0.0056	0.0045
206	Y	RR	C	Brown Fibrous	997-Pits	144+Instars	102	120	0	0	0	0.0306	0.0217	0.0255
207	Y	RR	C	Brown Fibrous	997-Pits	30	56	46	0	0	0	0.0047	0.0087	0.0071
208	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
209	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
210	Y	RR	C	Brown Fibrous	997-Pits	58+Instars	52	37	0	0	0	0.0166	0.0149	0.0106
211	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
212	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
213	Y	RR	C	Brown Fibrous	997-Pits	38	27	21	0	0	0	0.0093	0.0066	0.0051
214	N	RR	C	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
215	Y	RR	C	Brown Fibrous	997-Pits	132+Instars	101	64	0	0	0	0.0115	0.0088	0.0056
216	Y	RR	C	Brown Fibrous	997-Pits	10	13	9	0	0	0	0.0008	0.0011	0.0007
217	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
218	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
219	Y	RR	C	Brown Fibrous	997-Pits	90	60	75	0	0	0	0.0167	0.0111	0.0139
220	Y	RR	C	Brown Fibrous	997-Pits	15	13	21	9	21	18	0.0010	0.0009	0.0014
221	Y	RR	C	Red Brown Fibrous	997-Pits	5	9	11	0	0	0	0.0010	0.0019	0.0023
222	Y	RR	C	Brown Fibrous	997-Pits	24	20	28	0	0	0	0.0090	0.0075	0.0105
223	Y	RR	C	Red Brown Fibrous	997-Pits	52	28	44	0	0	0	0.0132	0.0071	0.0112
224	Y	RR	C	Brown Fibrous	997-Pits	0	0	0	0	0	0	0.0000	0.0000	0.0000
225	Y	RR	C	Brown Fibrous	997-Pits	59	46	25	0	0	0	0.0082	0.0064	0.0035
226	Y	RR	C	Brown Fibrous	997-Pits	33	60	24	0	0	0	0.0045	0.0081	0.0032
227	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
228	Y	RR	C	Brown Fibrous	997-Pits	36+Instars	51	24	0	0	0	0.0072	0.0102	0.0048

*CP = Clay Pit SVRA, RR = Rabe Road Vernal Pool Management Area, DWR = Department of Water Resources Vernal Pool Management Area
**OTFTC = Oroville-Thermalito-Fernandez-Thompsonflat Complex

Table 2. Results of Soil Examinations

Basin No.	Surveyed (Y/N)	*Area	Control or Treatment	Soil Type	**Soil Mapping Unit	Branchinecta sp. Cysts			Lepidurus Packardi/Triops Cysts			Intact Cyst Concentration	Broken Cyst Concentration	Fragment Cyst Concentration
						Intact	Broken	Fragments	Intact	Broken	Fragments			
229	Y	RR	C	Brown Fibrous	997-Pits	325	275	120	0	0	0	0.0435	0.0368	0.0160
230	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
231	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
232	Y	RR	C	Red Brown Fibrous	997-Pits	32	36	24	0	0	0	0.0083	0.0094	0.0063
233	Y	RR	C	Brown Fibrous	997-Pits	84	95	50	0	0	0	0.0094	0.0106	0.0056
234	Y	RR	C	Brown Fibrous	997-Pits	39	45	21	0	0	0	0.0062	0.0072	0.0033
235	Y	RR	C	Brown Fibrous	997-Pits	28	16	8	0	0	0	0.0027	0.0015	0.0008
236	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
237	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
238	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
239	Y	RR	C	Red Brown Fibrous	997-Pits	7	5	9	0	0	0	0.0019	0.0013	0.0024
240	Y	RR	C	Brown Fibrous	997-Pits	93	104	117	0	0	0	0.0155	0.0173	0.0195
241	Y	RR	C	Brown Fibrous	997-Pits	21	15	9	0	0	0	0.0048	0.0034	0.0020
242	Y	RR	C	Brown Fibrous	997-Pits	27	33	18	0	0	0	0.0034	0.0042	0.0023
243	Y	RR	C	Brown Fibrous	997-Pits	92	64	38	0	0	0	0.0075	0.0052	0.0031
244	Y	RR	C	Brown Fibrous	997-Pits	22	16	34	0	0	0	0.0033	0.0024	0.0052
245	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
246	Y	RR	C	Brown Fibrous	997-Pits	18	21	9	0	0	0	0.0060	0.0070	0.0030
247	Y	RR	C	Brown Fibrous	997-Pits	30	20	15	0	0	0	0.0032	0.0021	0.0016
248	Y	RR	C	Brown Fibrous	997-Pits	16	20	32	0	0	0	0.0046	0.0058	0.0093
249	Y	RR	C	Brown Fibrous	997-Pits	145	120	75	0	0	0	0.0892	0.0738	0.0461
250	Y	RR	C	Brown Fibrous	997-Pits	48	66	36	0	0	0	0.0124	0.0170	0.0093
251	Y	RR	C	Brown Fibrous	997-Pits	15	21	24	0	0	0	0.0023	0.0032	0.0037
252	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
253	Y	RR	C	Red Brown Fibrous	997-Pits	78	36	30	0	0	0	0.0133	0.0061	0.0051
254	N	RR	N/A	Unknown	997-Pits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
255	Y	RR	C	Tan Brown Fibrous	997-Pits	60	40	36	0	0	0	0.0073	0.0049	0.0044
256	Y	DWR1	C	Red Brown Fibrous	603-OTFTC	58	35	46	0	0	0	0.0125	0.0075	0.0099
257	Y	DWR1	C	Red Brown Fibrous	603-OTFTC	35	45	50	0	0	0	0.0139	0.0179	0.0198
258	Y	DWR1	C	Red Brown Fibrous	603-OTFTC	120	90	108	0	0	0	0.0233	0.0175	0.0209
259	Y	DWR1	C	Brown Fibrous	603-OTFTC	126+Instars	90	96	0	0	0	0.0294	0.0210	0.0224
260	Y	DWR1	C	Red Brown Fibrous	603-OTFTC	0	2	3	0	0	0	0.0000	0.0011	0.0016
261	Y	DWR1	C	Brown Fibrous	603-OTFTC	0	0	0	0	0	0	0.0000	0.0000	0.0000
262	Y	DWR1	C	Brown Fibrous	603-OTFTC	0	0	0	0	0	0	0.0000	0.0000	0.0000
263	N	DWR1	N/A	Unknown	603-OTFTC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
264	Y	DWR1	C	Brown Fibrous	603-OTFTC	0	0	0	0	0	0	0.0000	0.0000	0.0000
265	Y	DWR1	C	Brown Fibrous	603-OTFTC	0	2	4	0	0	0	0.0000	0.0004	0.0007
266	Y	DWR2	C	Brown Fibrous	996-Dumps	0	0	0	0	0	0	0.0000	0.0000	0.0000
267	Y	DWR2	C	Brown Fibrous	996-Dumps	25	28	13	0	0	0	0.0080	0.0089	0.0041
268	Y	DWR2	C	Brown Fibrous	996-Dumps	30	18	12	0	0	0	0.0068	0.0041	0.0027
269	Y	DWR2	C	Tan Brown Fibrous	996-Dumps	24	42	45	0	0	0	0.0165	0.0290	0.0310
270	Y	DWR2	C	Brown Fibrous	996-Dumps	0	0	0	0	0	0	0.0000	0.0000	0.0000
271	Y	DWR2	C	Brown Fibrous	996-Dumps	9	15	14	0	0	0	0.0036	0.0060	0.0056
272	N	DWR2	N/A	Unknown	996-Dumps	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
273	Y	DWR3	C	Red Brown Soil	603-OTFTC	0	0	0	0	0	0	0.0000	0.0000	0.0000
274	Y	DWR3	C	Red Brown Fibrous	603-OTFTC	39	18	12	0	0	0	0.0090	0.0041	0.0028

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						Intact	Broken	Fragments	Intact	Broken	Fragments			
275	Y	DWR3	C	Red Brown Soil	603-OTFTC	104	60	48	0	0	0	0.0147	0.0085	0.0068
276	Y	DWR3	C	Red Brown Fibrous	603-OTFTC	54	32	33	0	0	0	0.0394	0.0234	0.0241
277	Y	DWR3	C	Red Fibrous	603-OTFTC	1	1	7	0	0	0	0.0014	0.0014	0.0099
278	Y	DWR3	C	Red Brown Clay	603-OTFTC	33+Instars	63	39	0	0	0	0.0055	0.0104	0.0064
279	Y	DWR3	C	Brown Fibrous	603-OTFTC	4	1	3	0	0	0	0.0018	0.0004	0.0013
280	Y	DWR3	C	Brown Fibrous	603-OTFTC	3	9	11	0	0	0	0.0011	0.0033	0.0040

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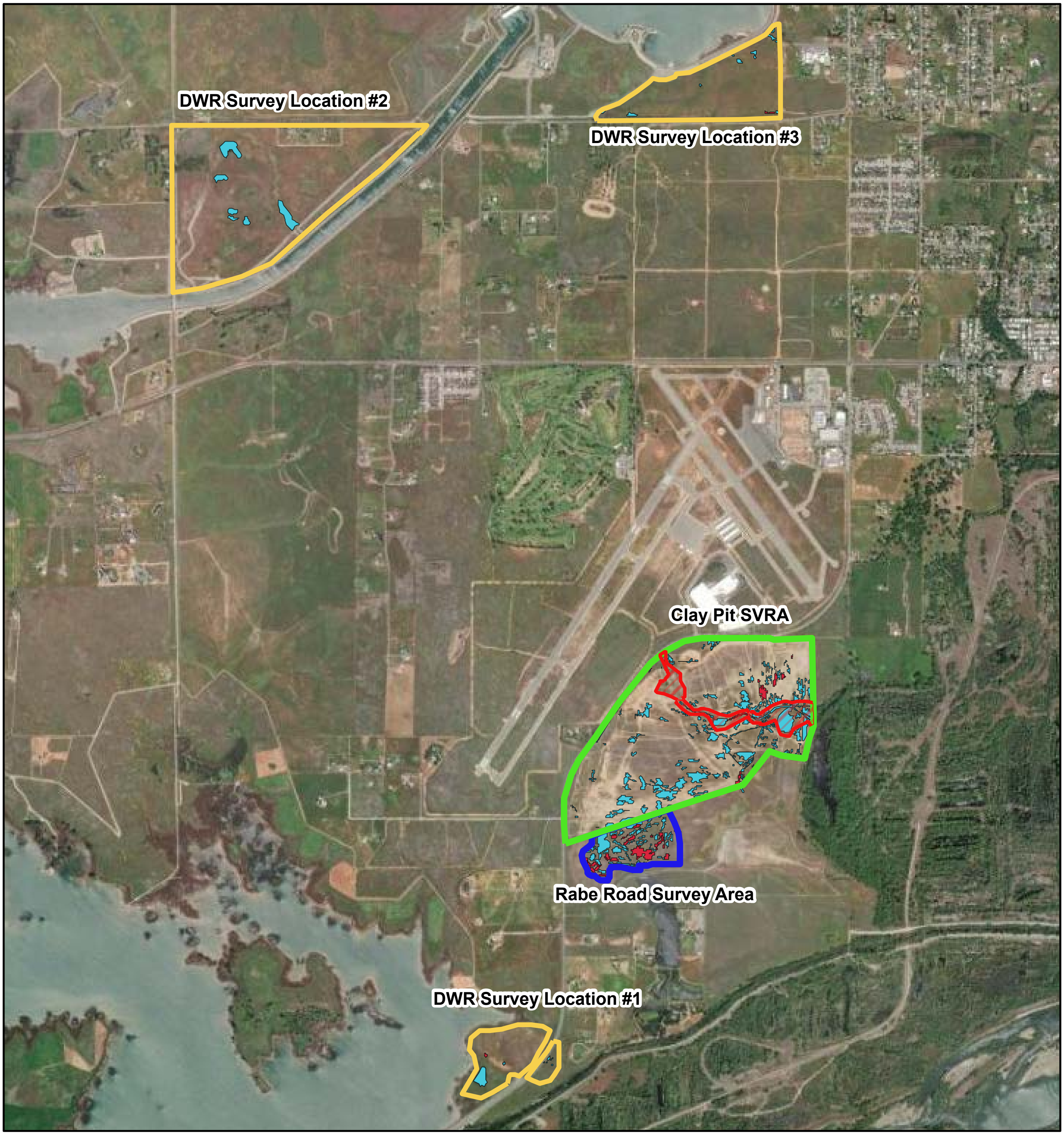
**OTFTC = Oroville-Thermalito-Fernandez-Thompsonflat Complex

APPENDIX C.
MAPS OF SURVEY AREA AND BASINS SAMPLED

Clay Pit SVRA Dry Season Sampling - Survey Locations



9/18/2024

DWR VPMA
Drainage Buffer Fenceline
Drainage Buffer (No OHV Allowed)
SVRA Boundary
Rabe Road Vernal Pool Management Area (CDFW)
Dry Season Survey Features
Features Surveyed
Features Not Surveyed
World Imagery
Low Resolution 15m Imagery
High Resolution 60cm Imagery
High Resolution 30cm Imagery Maxar
Citations
9.6m Resolution Metadata

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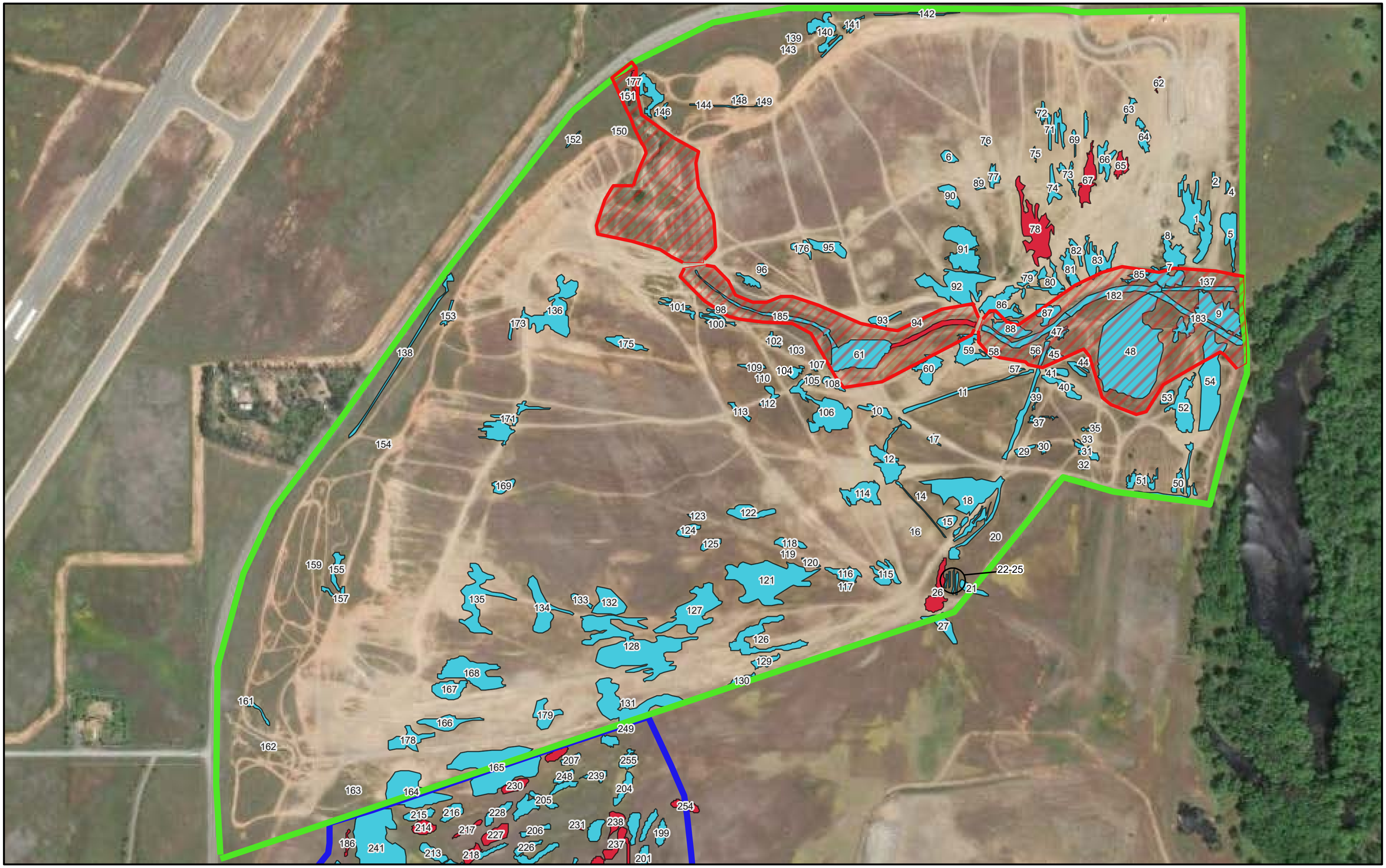
0 0.4 0.8 1.6 km

Survey Features - Clay Pit SVRA



9/18/2024

Drainage Buffer Fenceline
Drainage Buffer (No OHV Allowed)
SVRA Boundary
Rabe Road Vernal Pool Management Area (CDFW)

Dry Season Survey Features
Features Surveyed
Features Not Surveyed
World Imagery
Low Resolution 15m Imagery

High Resolution 60cm Imagery
High Resolution 30cm Imagery
Citations
2.4m Resolution Metadata

Maxar

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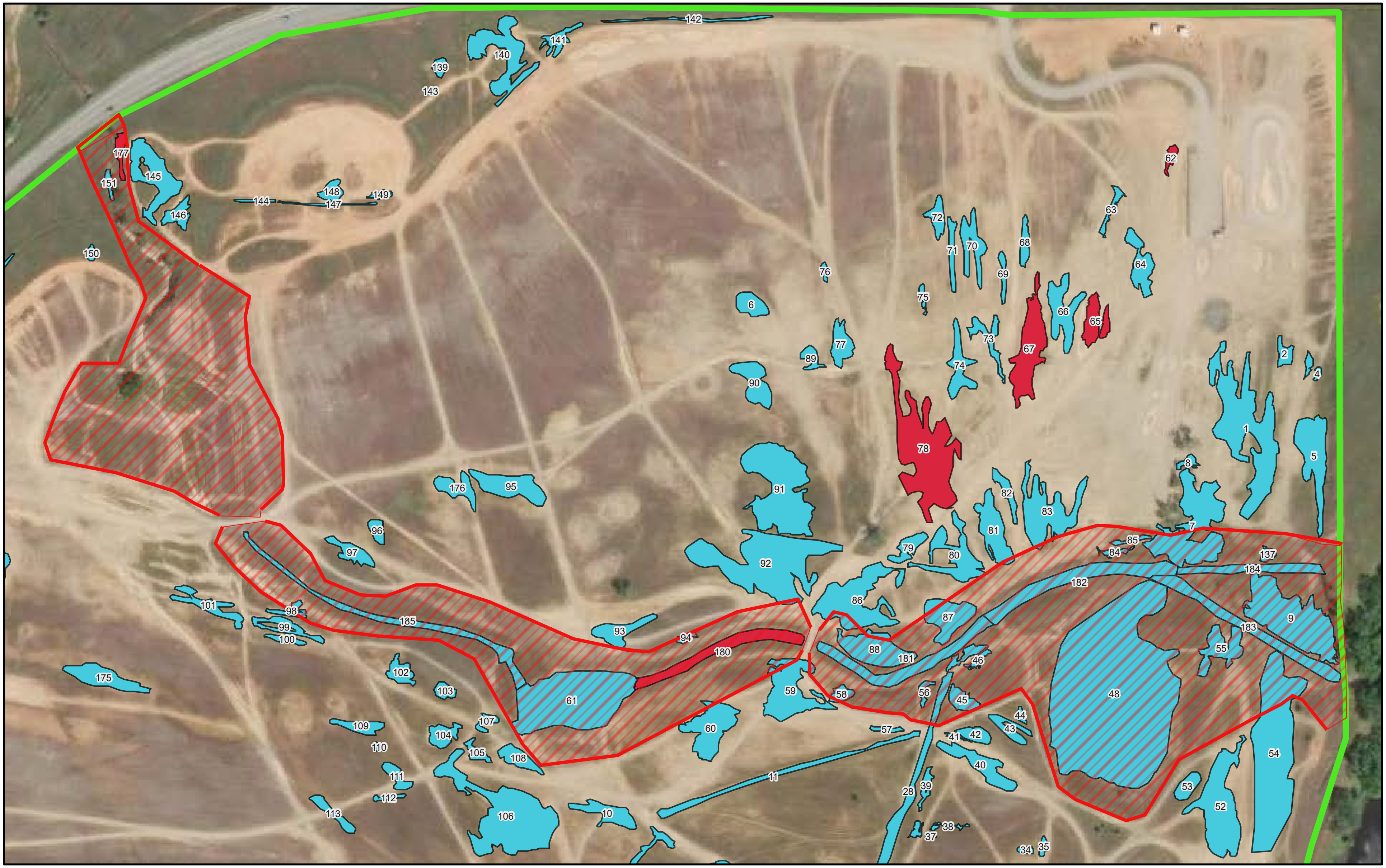
0 0.07 0.15 0.3 km

Survey Features - Clay Pit SVRA Drainage Buffer



9/18/2024

Drainage Buffer Fenceline
Drainage Buffer (No OHV Allowed)
SVRA Boundary
Dry Season Survey Features
Features Surveyed
Features Not Surveyed
World Imagery
Low Resolution 15m Imagery
High Resolution 60cm Imagery
High Resolution 30cm Imagery
Citations
1.2m Resolution Metadata

Maxar

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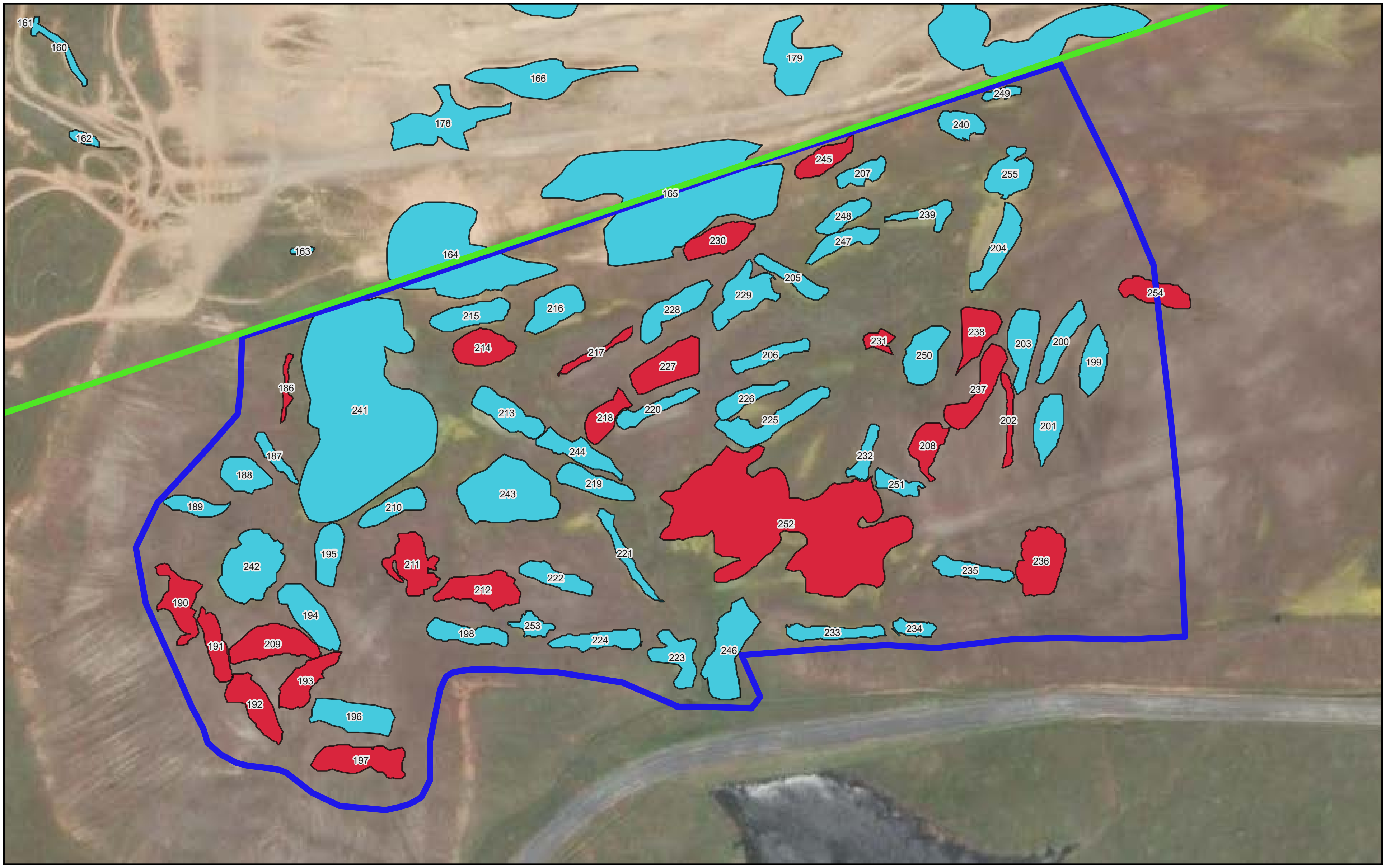
0 0.04 0.09 0.18 km

Survey Features - Rabe Road Vernal Pool Management Area (CDFW)



9/18/2024

SVRA Boundary

Rabe Road Vernal Pool Management Area (CDFW)

Dry Season Survey Features

Features Surveyed

Features Not Surveyed

World Imagery

Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

Citations

1.2m Resolution Metadata

Maxar

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0 0.02 0.04 0.09 mi

0 0.04 0.07 0.14 km

Survey Features - DWR Survey Location #1

9/18/2024

DWR VPMA

Dry Season Survey Features

Features Surveyed

Features Not Surveyed

World Imagery

Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

Citations

60cm Resolution Metadata

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0 0.03 0.07 0.13 km

Maxar, Microsoft

Survey Features - DWR Survey Location #2

9/18/2024

DWR VPMA

Dry Season Survey Features

Features Surveyed

World Imagery

Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

Citations

2.4m Resolution Metadata

Maxar

1:8,500

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0 0.07 0.15 0.3 km

Survey Features - DWR Survey Location #3

9/18/2024

DWR VPMA

Dry Season Survey Features

Features Surveyed

Features Not Surveyed

World Imagery

Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

Citations

1.2m Resolution Metadata

Maxar

1:5,500

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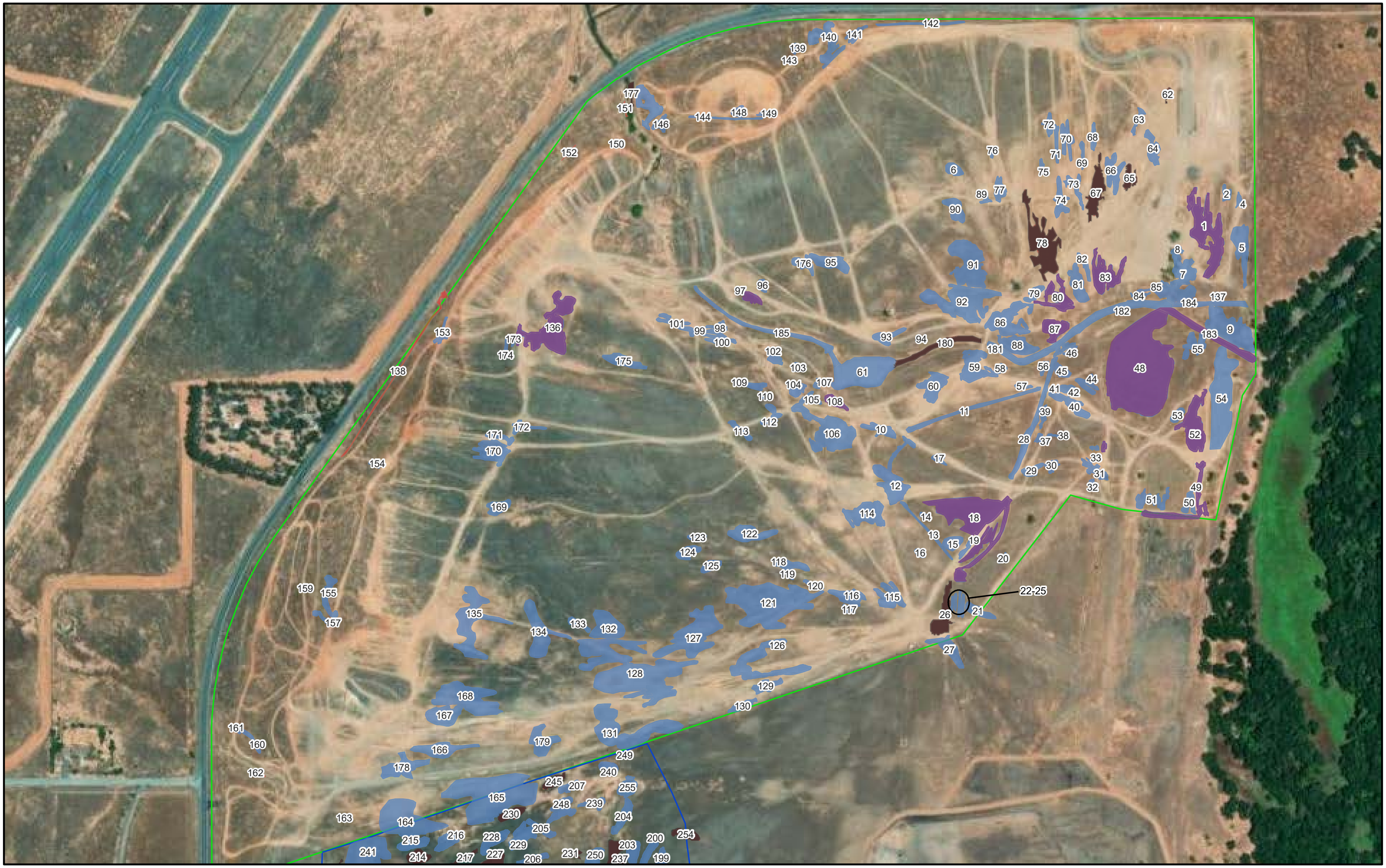
0 0.05 0.1 0.2 km

APPENDIX D.
MAPS OF BRANCHIOPOD CYST DISTRIBUTIONS AND CONCENTRATIONS

Branchiopod Cyst Distribution - Clay Pit SVRA (2023)



3/11/2025

- Not Surveyed
- Lepidurus/Triops & Branchinecta Cysts Present
- Branchinecta Cysts Present
- No Cysts Detected
- Rabe Road Vernal Pool Management Area (CDFW)
- SVRA Boundary

World Imagery

Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

Citations

Maxar

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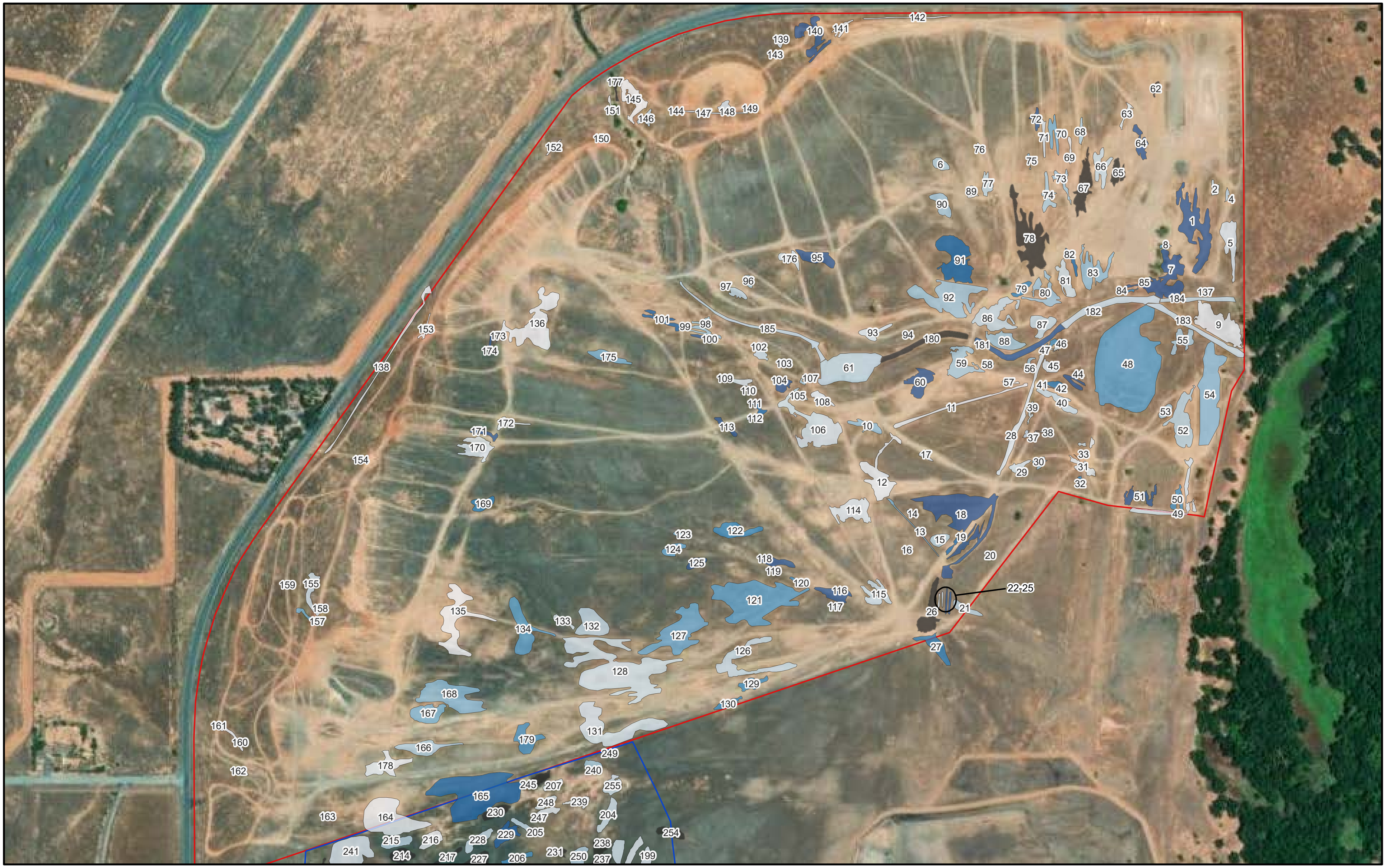
Branchiopod Cyst Concentrations - Clay Pit SVRA (2023)



3/10/2025

Branchiopod Cyst Concentrations

0.216196

0

Not Surveyed

Rabe Road Vernal Pool Management Area (CDFW)

SVRA Boundary

World Imagery

Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

Citations

Maxar

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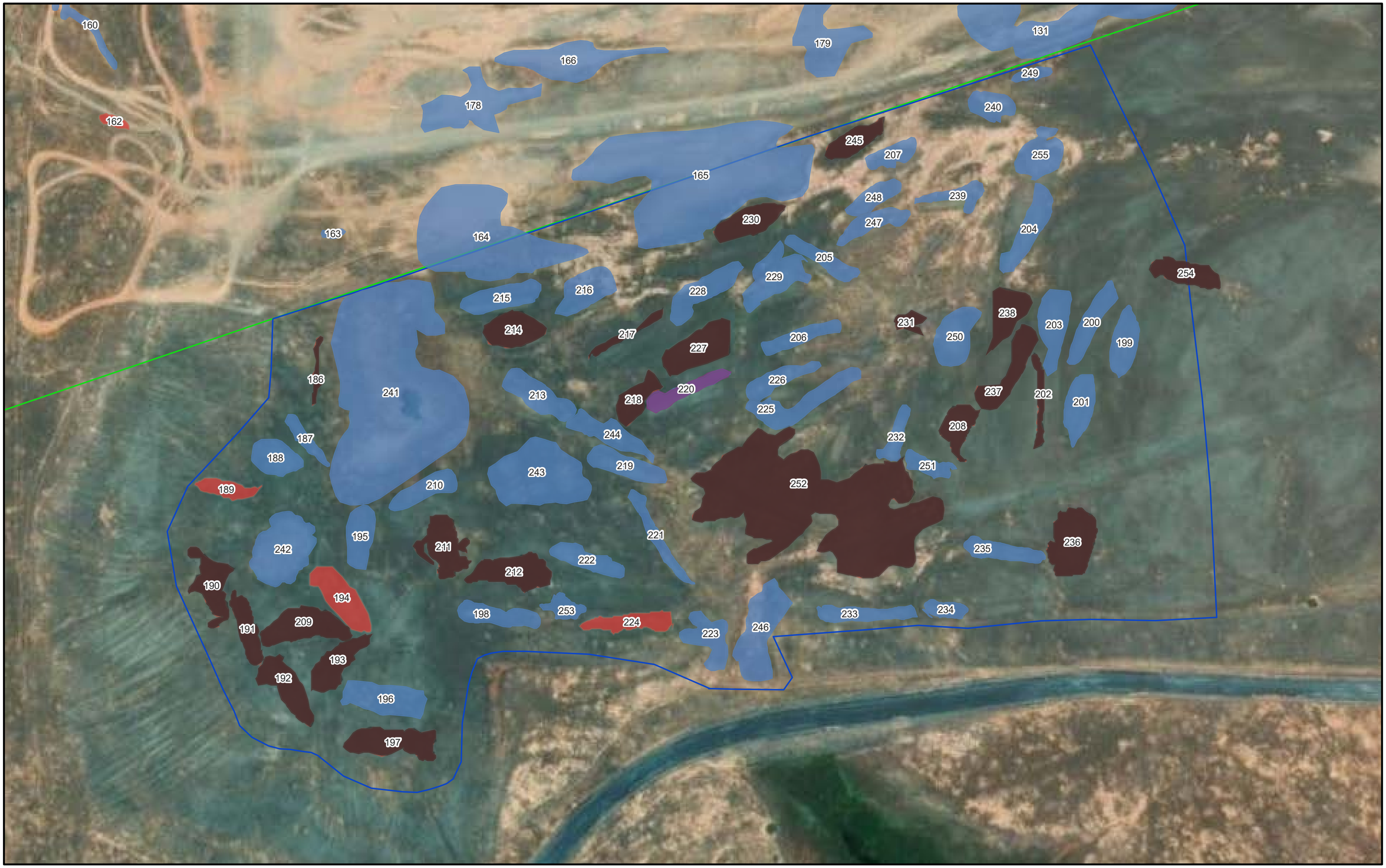
0 0.07 0.15 0.3 km

Branchiopod Cyst Distribution - Rabe Road VPMA (2023)



3/11/2025

Not Surveyed
Lepidurus/Triops & Branchinecta Cysts Present
Branchinecta Cysts Present
No Cysts Detected

Rabe Road Vernal Pool Management Area (CDFW)
SVRA Boundary
World Imagery
Low Resolution 15m Imagery

High Resolution 60cm Imagery
High Resolution 30cm Imagery
Citations

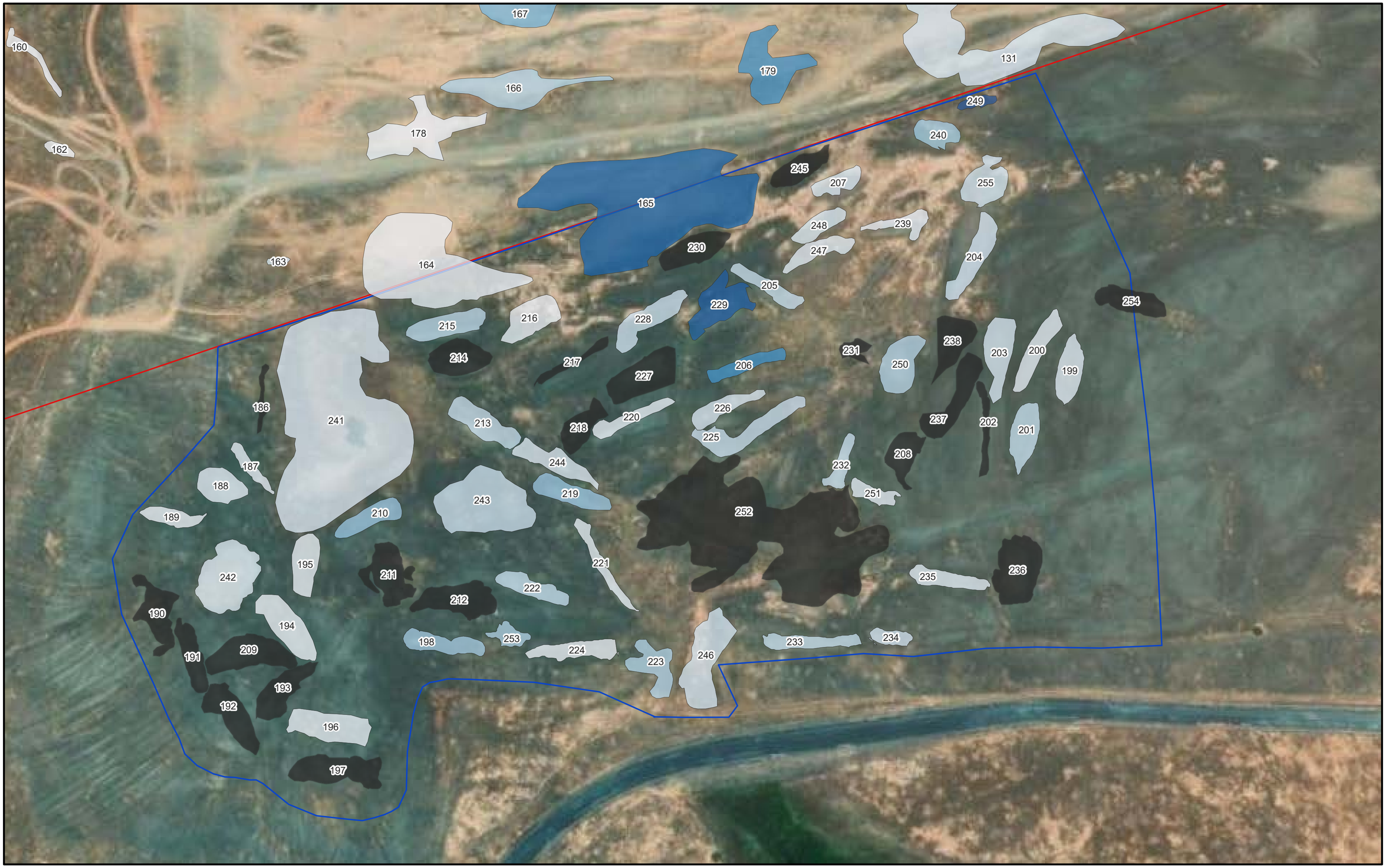
Maxar

1:3,500

0 0.02 0.04 0.09 mi

0 0.04 0.07 0.14 km

Branchiopod Cyst Concentrations - Rabe Road VPMA (2023)



3/10/2025

Branchiopod Cyst Concentrations

0.216196

0

Not Surveyed

Rabe Road Vernal Pool Management Area (CDFW)

SVRA Boundary

World Imagery

Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

Citations

Maxar

1:3,500

0 0.02 0.04 0.09 mi

0 0.04 0.07 0.14 km

Branchiopod Cyst Distribution - DWR VPMA #1 (2023)

3/11/2025

Not Surveyed
Branchinecta Cysts Present
No Cysts Detected

DWR Vernal Pool Management Area
World Imagery
Low Resolution 15m Imagery

High Resolution 60cm Imagery
High Resolution 30cm Imagery
Citations

Maxar

1:3,500

0 0.02 0.04 0.09 mi

0 0.04 0.07 0.14 km

Branchiopod Cyst Concentrations - DWR VPMA #1 (2023)

3/10/2025

Branchiopod Cyst Concentrations
0.216196
0
Not Surveyed

DWR Vernal Pool Management Area
World Imagery
Low Resolution 15m Imagery
High Resolution 60cm Imagery
High Resolution 30cm Imagery
Citations
60cm Resolution Metadata

1:3,250
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0 0.03 0.07 0.13 km

Maxar, Microsoft

Branchiopod Cyst Distribution - DWR VPMA #2 (2023)

3/11/2025

Branchinecta Cysts Present

No Cysts Detected

DWR Vernal Pool Management Area

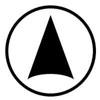
World Imagery

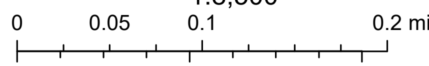
Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

Citations





Branchiopod Cyst Concentrations - DWR VPMA #2 (2023)

3/10/2025

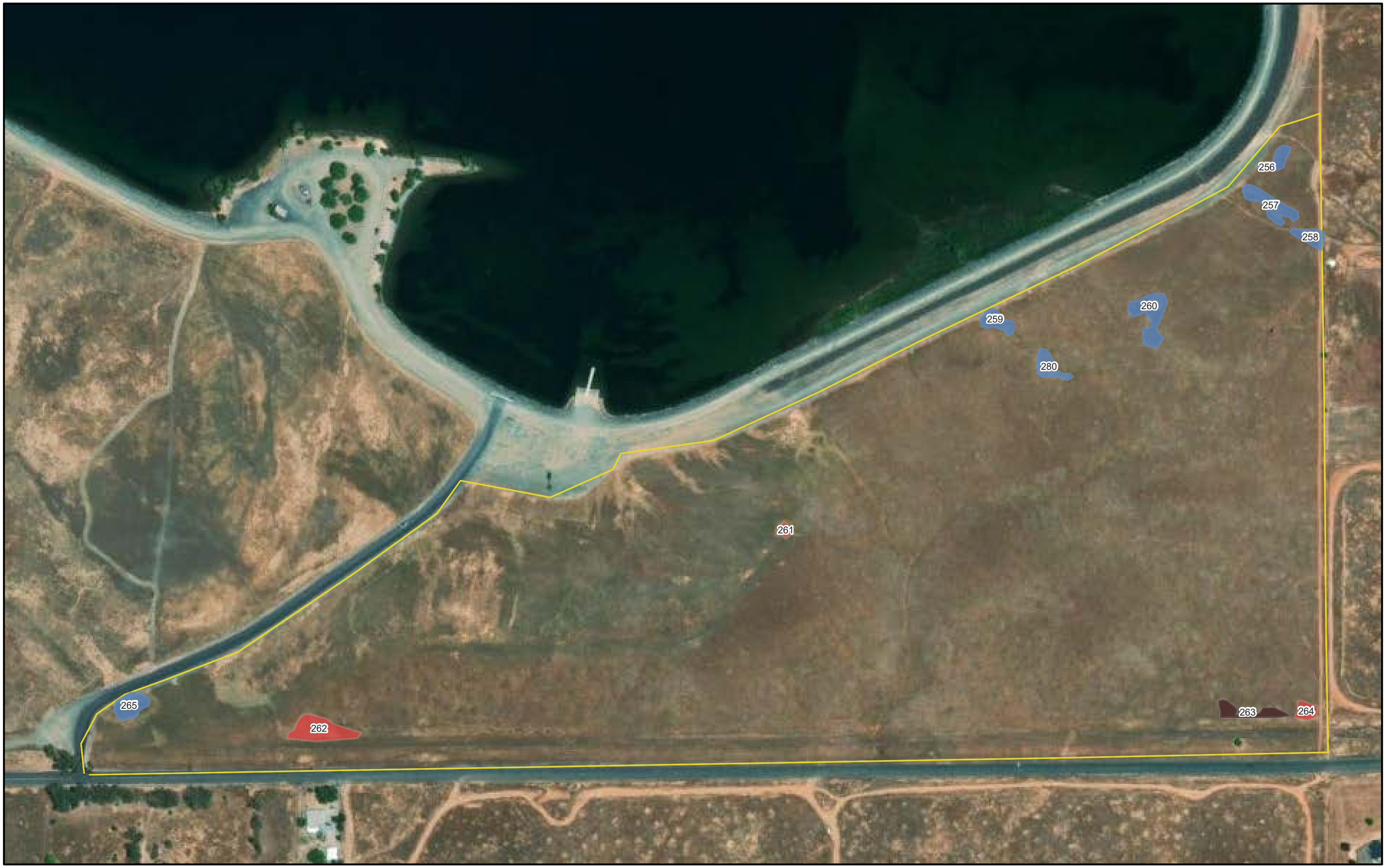
Branchiopod Cyst Concentrations
0.216196
0
Not Surveyed

DWR Vernal Pool Management Area
World Imagery
Low Resolution 15m Imagery
High Resolution 60cm Imagery
High Resolution 30cm Imagery
Citations

1:8,500
0 0.05 0.1 0.2 mi
0 0.07 0.15 0.3 km

Maxar

Branchiopod Cyst Distribution - DWR VPMA #3 (2023)



3/11/2025

Not Surveyed
Branchinecta Cysts Present
No Cysts Detected
DWR Vernal Pool Management Area

World Imagery
Low Resolution 15m Imagery
High Resolution 60cm Imagery
High Resolution 30cm Imagery

Citations
1.2m Resolution Metadata

Maxar

1:5,500

0 0.04 0.07 0.14 mi

0 0.05 0.1 0.2 km

Branchiopod Cyst Concentrations - DWR VPMA #3 (2023)

3/10/2025

Branchiopod Cyst Concentrations

0.216196

0

Not Surveyed

DWR Vernal Pool Management Area

World Imagery

Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

Citations

1.2m Resolution Metadata

1:5,500

0 0.04 0.07 0.14 mi

0 0.05 0.1 0.2 km

Maxar

APPENDIX E.
REPRESENTATIVE PHOTOGRAPHS

Photograph of Feature 48 taken by Shane Emerson on October 30, 2023.

Photograph of Feature 61 taken by Shane Emerson on October 30, 2023.

Photograph of Feature 84 taken by Shane Emerson on October 30, 2023.

Photograph of Feature 87 taken by Shane Emerson on October 30, 2023.

Photograph of Feature 104 taken by Shane Emerson on October 30, 2023.

Photograph of Feature 180 taken by Shane Emerson on October 30, 2023.

Photograph of Feature 88 taken by Shane Emerson on October 30, 2023.

Photograph of Feature 90 taken by Dr. Brent Helm on October 30, 2023.

Photograph of Feature 36 taken by Dr. Brent Helm on October 30, 2023.

Photograph of Feature 42 taken by Dr. Brent Helm on October 30, 2023.

Photograph of Feature 59 taken by Dr. Brent Helm on October 30, 2023.

Photograph of Feature 104 taken by Dr. Brent Helm on October 30, 2023.

Photograph of Feature 134 taken by Dr. Brent Helm on October 30, 2023.

Photograph of Feature 125 taken by Dr. Brent Helm on October 30, 2023.

Photograph of Feature 154 taken by Dr. Brent Helm on October 30, 2023.

Photograph of Feature 150 taken by Dr. Brent Helm on October 30, 2023.