APPENDIX H

2017 Dry Season Fairy Shrimp Sampling Results

DUDEK

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August 17, 2017 9420-03

U.S. Fish and Wildlife Service
Attn: Recovery Permit Coordinator
2177 Salk Avenue, Suite 250
Carlsbad, California 92008

Subject: ***2017 Dry Season Survey for Vernal Pool Branchiopods, City of San Diego Pure Water Project, San Diego County, California***

Dear Recovery Permit Coordinator:

The 2017 dry season survey for the presence or absence of two federally listed endangered vernal pool branchiopod species, Riverside fairy shrimp (*Streptocephalus woottoni*) and San Diego fairy shrimp (*Branchinecta sandiegonensis*), was conducted on June 9, 2017. Dudek biologist Paul Lemons (TE-051248-5) conducted the soil collection according to the Survey Guidelines for the Listed Large Branchiopods (USFWS 2015). This report summarizes the results of the 2017 dry season survey in order to fulfill the report requirements in accordance with the Section 10(a)(1)(A) Recovery Permit for the Pure Water San Diego Program North City Project, located in San Diego County, California.

Soil samples from a total of 30 basins were collected during the 2017 dry season survey. Focused surveys were conducted during the 2016/17 wet season for 19 of the 30 basins. 11 basins were not previously surveyed.

The 2017 dry season soil collection was performed by Dudek biologist Paul Lemons (Permit # TE051248-5) with assistance from Dudek biologist Jeff Priest. Soil samples were collected on June 9, 2017. The samples were then submitted to, and later evaluated and cysts cultured by, biologist Greg Mason (Alden Environmental, Inc.). The survey focused on the determination of the presence/absence of two federally listed endangered vernal pool branchiopod species, Riverside fairy shrimp (*Streptocephalus woottoni*) and San Diego fairy shrimp (*Branchinecta sandiegonensis*), and was conducted according to the *Survey Guidelines for the Listed Large Branchiopods* (USFWS, 2015).

PROJECT LOCATION AND EXISTING CONDITIONS

Proposed North City Project pipelines extend through the cities of San Diego, Santee, and the community of Lakeside in unincorporated San Diego County, in addition to federal lands within MCAS Miramar (Figure 1, Regional Map). The Project site occupies portions of Township 14

South, Range 1 East, projected Sections 30 and 31; Township 14 South, Range 1 West, projected Sections 25 and 36; Township 14 South, Range 2 West, projected Sections 32, and 33; Township 15 South, Range 1 East, projected Sections 6 and 18; Township 15 South, Range 1 West, projected Sections 1, 23, and 30; Township 15 South, Range 2 West, projected Sections 6, 25, 29, 30, 31, 32, 33, 35, and 36; Township 15 South, Range 3 West, projected Sections 9, 10, 11, 16, 17, 20, 25, 26, and 28; Township 16 South, Range 2 West, projected Sections 1, 2, 3, and 4; and Township 16 South, Range 3 West, projected Section 9 on the San Vicente Reservoir, El Cajon, La Mesa, Poway, La Jolla, and Del Mar U.S. Geological Survey 7.5 minute quadrangle maps (Figure 2, Vicinity Map).

Elevations range from about 94 feet amsl in the southwestern portion of the Project site to approximately 688 feet amsl.

Soils within the Project site consist of acid igneous rock land; Altamont clay; Carlsbad-Urban Land complex, Chesterton fine sandy loam; Chesterton-Urban Land complex; Cieneba rocky and very rocky coarse sandy loam, Cieneba-Fallbrook rocky sandy loam; Diablo clay; Diablo-Olivenhain complex; Diablo-Urban land complex; Fallbrook sandy loam; Fallbrook-Vista sandy loam; Friant rocky fine sandy loam; Gaviota fine sandy loam; gravel pits; Huerhuero loam; metamorphic rock land; Olivenhain cobbly loam; Ramona sandy loam; Redding cobbly and gravelly loam; Redding-Urban land complex; riverwash; Salinas clay loam; stony land; terrace escarpments; Tujunga sand; and Visalia sandy loam (SanGIS 2016).

VEGETATION COMMUNITIES, DEPRESSIONS, AND LAND COVER TYPES

A total of 28 vegetation communities and/or land cover types were identified within a 500-foot buffer of the Miramar Reservoir Alternative study area, and 26 vegetation communities and/or land cover types were observed within a 500-foot buffer of the San Vicente Pipeline Alternative study area. Dominate vegetation community/land cover categories within the study areas include disturbed and developed areas, scrub and chaparral, riparian and bottomlands, woodlands, and grasslands.

Suitable and potentially suitable habitat (i.e., ephemerally wet/ponded basins) for vernal pool branchiopods was identified on site and consists primarily of road rut (man-made) depressions, lacking vegetation, located immediately adjacent to roads and driveway access areas along the proposed project alignments; however, one basin (PWP 8) appears to be a naturally occurring pool adjacent to the Metro Biosolids Center (located north of State Route 52 (SR-52), adjacent to the Miramar Landfill). All of the basins surveyed are considered potentially suitable habitat for vernal pool branchiopods. All 19 basins surveyed were found in areas mapped as disturbed habitat.

Disturbed habitats are areas that have been physically disturbed and are no longer recognizable as native or naturalized vegetation associations (Oberbauer et al. 2008). These areas may continue to retail soil substrate. If vegetation is present, it is almost entirely composed of non-native vegetation, such as ornamentals or ruderal exotic species. Examples of these areas may include graded landscapes or areas, graded firebreaks, graded construction pads, construction staging areas, off-highway vehicle (OHV) trails, areas repeatedly cleared for fuel management, or repeatedly used areas that prevent revegetation (e.g., parking lots, trails that have persisted for years). On site, the dirt roads, dirt trails, and OHV areas are mapped as disturbed habitat.

PREVIOUS BRANCHIOPOD STUDIES

Dudek conducted presence/absence surveys for vernal pool branchiopods within 19 of the 30 basins discussed in this report during the 2016/17 wet season. The 19 basins surveyed during the 2016/17 wet season include PWP1 through PWP19. To Dudek's knowledge, no previous protocol-level surveys have been conducted within the additional 11 basins (VP5, VP8, VP10, VP11, VP12, VP15, VP17, VP18, VP19, VP26, and VP27) surveyed during the 2017 dry season and discussed in this report.

A general habitat assessment to evaluate the potential for vernal pool branchiopods within the survey area was conducted by Dudek biologist Brock Ortega in November 2016 prior to conducting protocol-level surveys.

SURVEY METHODS

Thirteen of the 30 basins were between 25 and 235 square meters, therefore 25 samples were collected from the lowest topographic areas of each of these basins. The remaining seventeen depressions were under 25 square meters, therefore 10 samples were collected from the lowest topographic areas of each of these basins. Small (6 inch) hand spades were used to excavate each sample (approximately 100ml each) of soil from the top 1-3 centimeters of soil. Data sheets were completed for each basin that was surveyed (Appendix A). Selected photographs of basins sampled are attached to this report as Appendix B.

Immediately after sample collection, each soil sample was carefully placed into plastic bags and labeled according to basin ID. Soil samples collected on June 9, 2017 from each basin were immediately submitted to Mr. Greg Mason of Alden Environmental, Inc. that same day. Soil samples were then processed by Mr. Mason for examination in the laboratory using the methods described in the dry season report by Alden Environmental, Inc. (Appendix C).

SURVEY RESULTS

Basin Descriptions

A total of 30 basins were surveyed during the 2017 dry survey season. The basins within the study area are distributed in topographically flat areas primarily along Eastgate Mall Road in the City of San Diego and Moreno Avenue in Lakeside, CA (Figures 3A-3G). Seventeen (17) of the basins are considered road ruts. Road ruts are depressions that are typically formed by vehicular traffic within or immediately adjacent to roadways, generally lack aquatic vegetation, and are heavily disturbed by vehicular traffic moderately to highly disturbed, showing evidence of current roadside disturbance (i.e., parked vehicles, trailers, tire tracks, trash). Thirteen basins (PWP 1, PWP 8, VP5, VP8, VP10, VP11, VP12, VP15, VP17, VP18, VP19, VP26, and VP27) are considered vernal pools. Vernal pools are depressions that retain sufficient water level, support vernal pool indicator plant species, and likely support vernal pool branchiopods.

Fairy Shrimp Presence/Absence

Results of the dry sample analysis yielded the presence of cysts from the fairy shrimp genus *Branchinecta* in 14 basins, including PWP 3, PWP 4, PWP 5, PWP 8, PWP 9, PWP 11, PWP 12, PWP 13, PWP 14, PWP 15, PWP 16, PWP 17, VP8, and VP11. All cysts collected from these basins were attempted to be cultured and raised to maturity to make a species-level identification. This attempt was successful in 12 of the 14 basins where cysts were collected. Only basins PWP 13 and PWP 16 failed to produce hatched shrimp, therefore, the cysts from these two basins could only be positively identified to genus level (i.e., *Branchinecta*). All shrimp that were successfully raised to maturity were identified as versatile fairy shrimp (*Branchinecta lindahli*). No listed San Diego fairy shrimp or Riverside fairy shrimp were identified during this dry season survey effort. Detailed results of soil analysis and cyst culturing are included in the Alden Environmental Report (Appendix C).

All required data collection information per the survey guidelines (USFWS, 2015) was recorded and is included as Appendices A through C of this report.

I certify that the information presented in this survey report and attached exhibits fully and accurately represents my work. Please feel free to contact me at 760.942.5147 if you have any questions regarding the contents of this report.

Sincerely,

Paul Lemons
TE051248

Att: Figures 1–3G
Appendix A, Survey Data Form
Appendix B, Photo Exhibits
Appendix C, Dry Season Fairy Shrimp Sampling Results (Alden Environmental, Inc.)

cc: Brock Ortega, Dudek
Greg Mason, Alden Environmental, Inc.

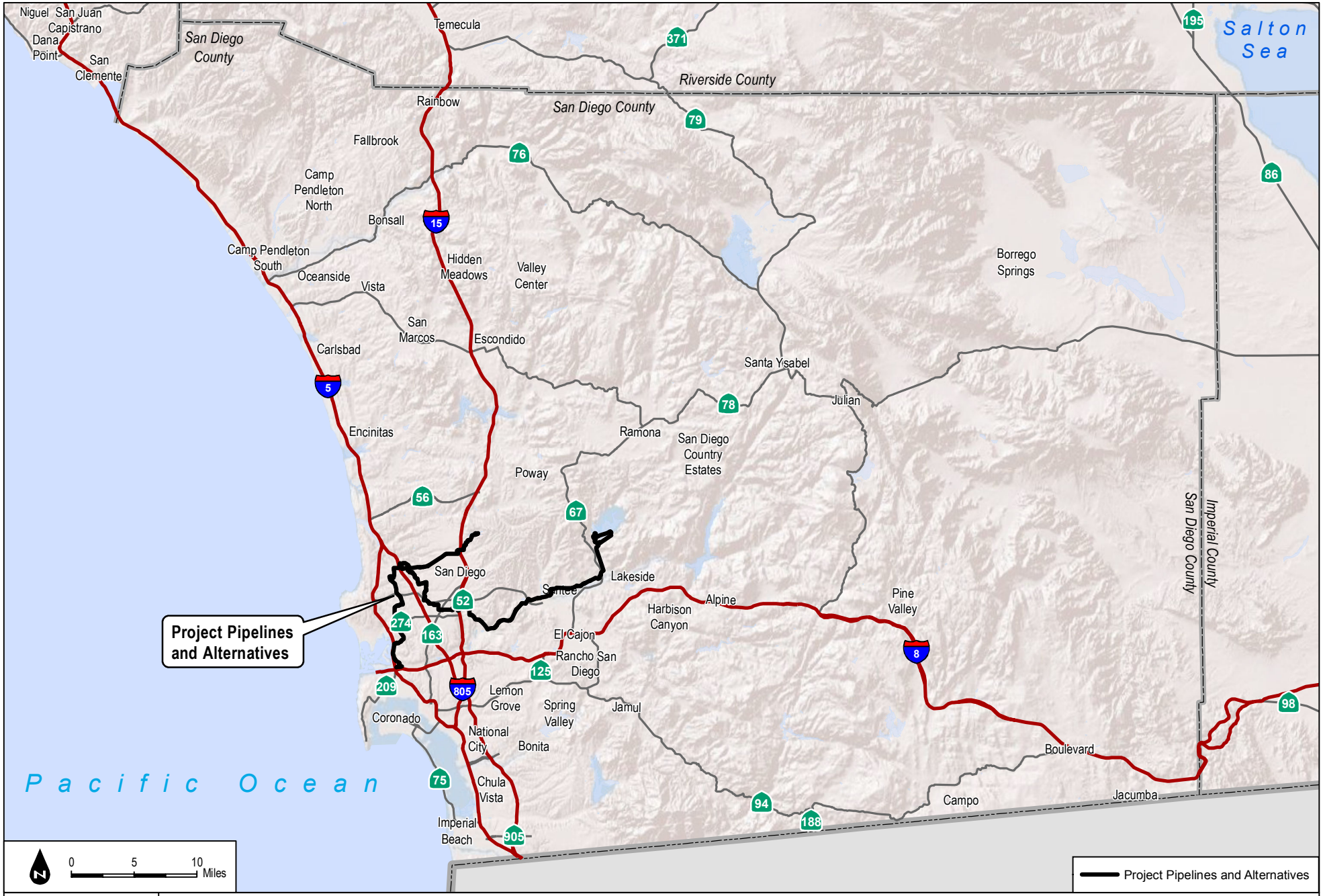
REFERENCES CITED

Bowman, R. H. 1973. *Soil Survey, San Diego Area, California, Part 1*. United States Department of Agriculture. 104 pp. + appendices.

Holland, R.F. 1986. *Preliminary Descriptions of the Terrestrial Natural Communities of California.* Nongame-Heritage Program. California Department of Fish and Game.

Oberbauer, Thomas, Meghan Kelley, and Jeremy Buegge. March 2008. *Draft Vegetation Communities of San Diego County.* Based on *Preliminary Descriptions of the Terrestrial Natural Communities of California*, Robert F. Holland, Ph.D., October 1986.

U.S. Fish and Wildlife Service (USFWS). 2015. *Survey Guidelines for the Listed Large Branchiopods*. Sacramento, California: U.S. Fish and Wildlife Service Sacramento Field Office. May 31.



SOURCE: City San Diego 2016; ESRI 2017

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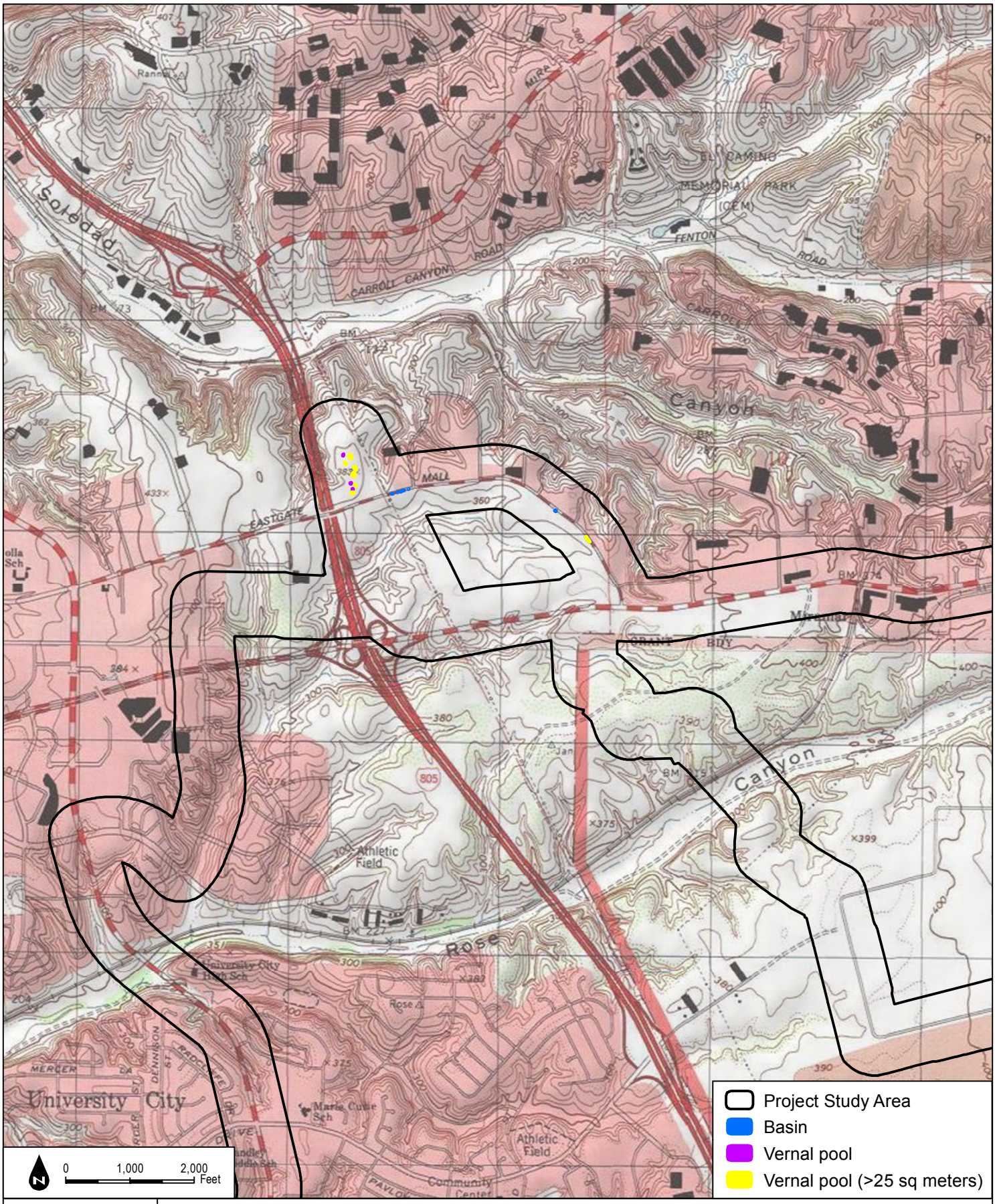
FIGURE 1

Regional Map

2017 Dry Season Survey for Vernal Pool Branchiopods, City of San Diego Pure Water Project, San Diego County, California



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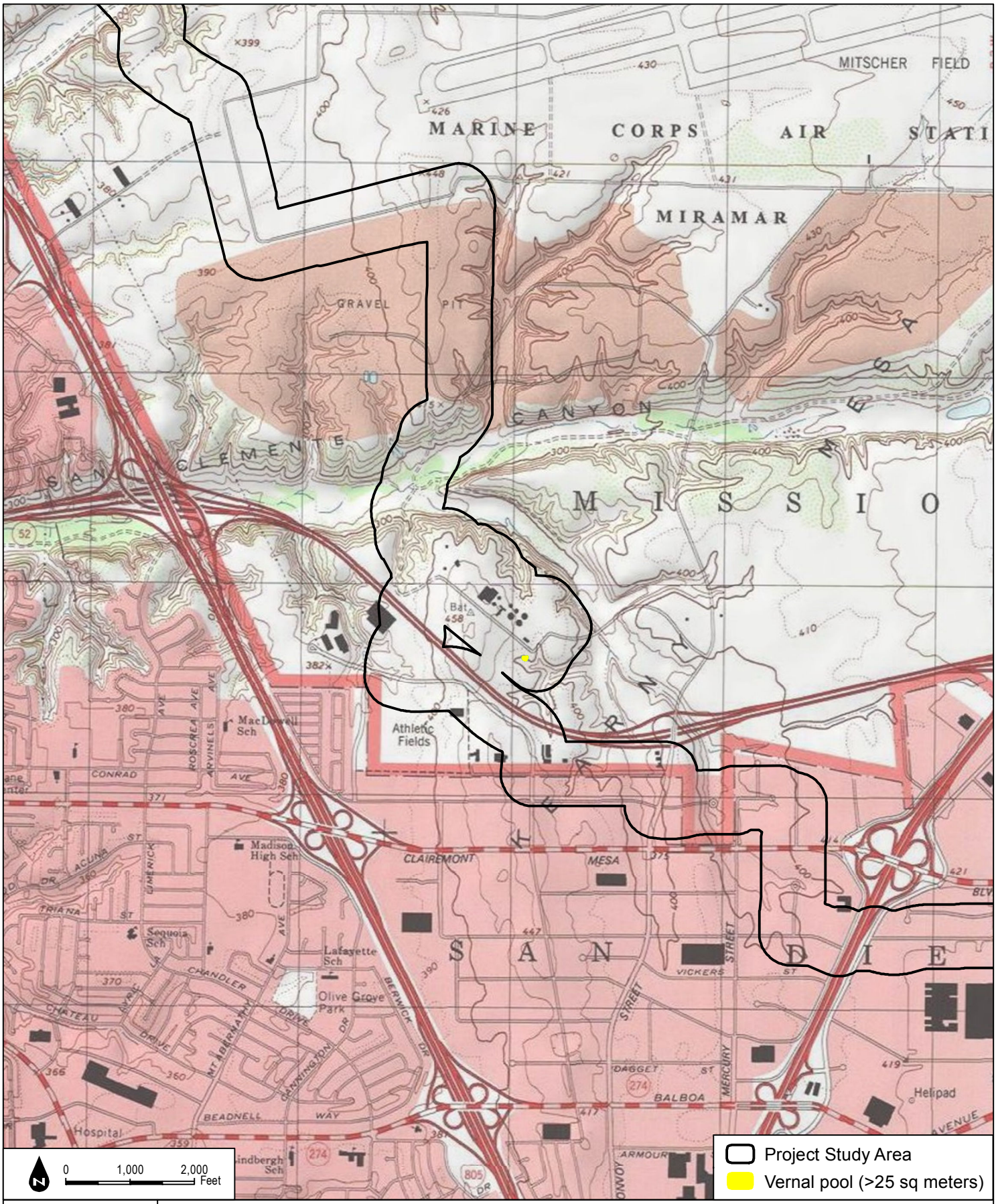
SOURCE: USGS 7.5-Minute Series El Cajon, San Vicente Reservoir Quadrangles.

FIGURE 2A

Vicinity Map

2017 Dry Season Survey for Vernal Pool Branchiopods, City of San Diego Pure Water Project, San Diego County, California

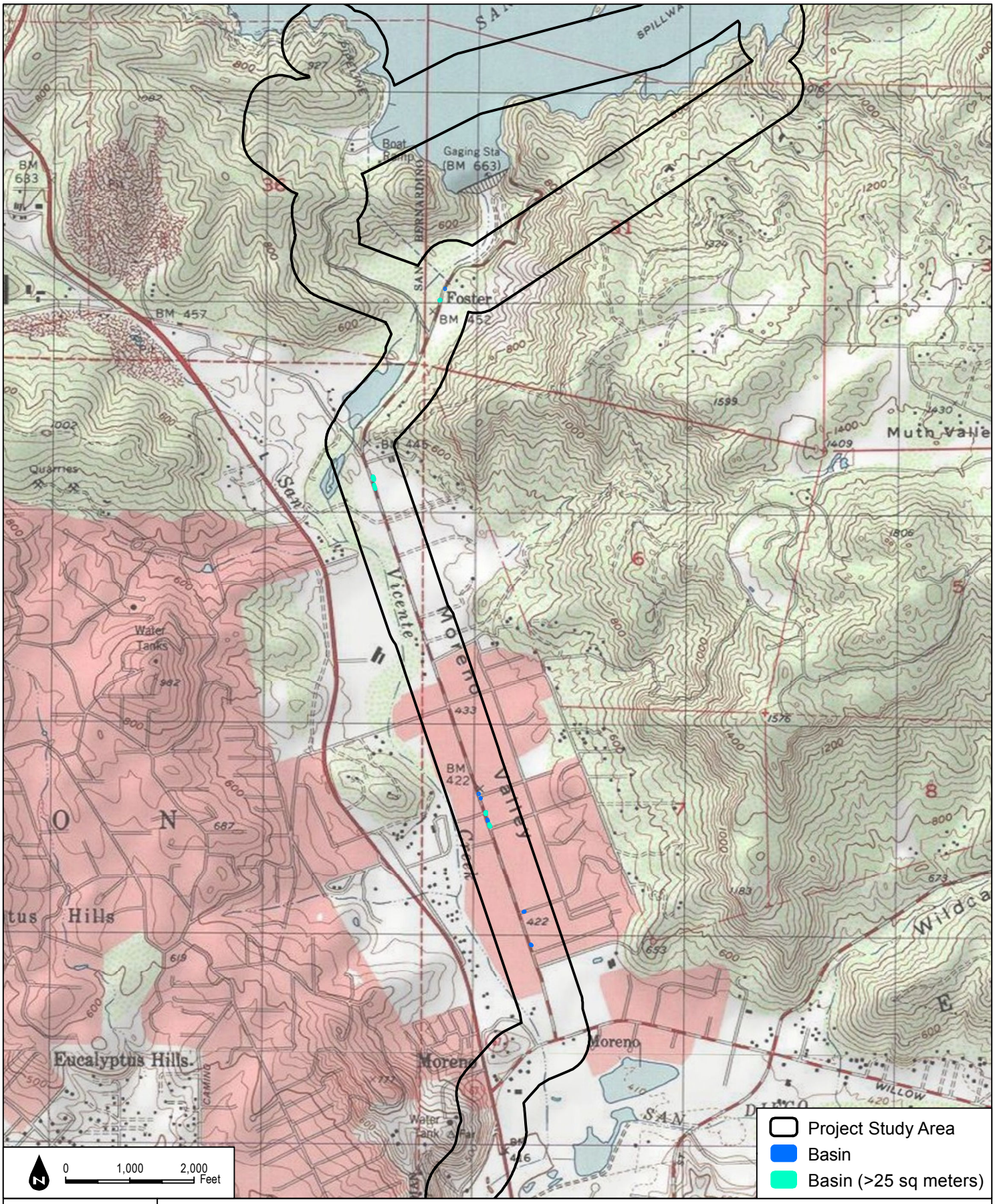


DUDEK

SOURCE: USGS 7.5-Minute Series El Cajon, San Vicente Reservoir Quadrangles.

FIGURE 2B
Vicinity Map

2017 Dry Season Survey for Vernal Pool Branchiopods, City of San Diego Pure Water Project, San Diego County, California



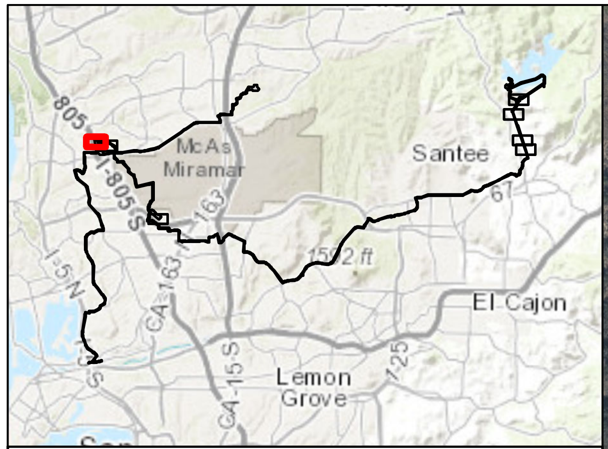
DUDEK

SOURCE: USGS 7.5-Minute Series El Cajon, San Vicente Reservoir Quadrangles.

FIGURE 2C

Vicinity Map

2017 Dry Season Survey for Vernal Pool Branchiopods, City of San Diego Pure Water Project, San Diego County, California



LEGEND

- Project Study Area
- San Vicente Pure Water Pipeline (San Vicente Pipeline)
- North City Pure Water Pipeline and San Vicente Pure Water Pipelines
- Vernal Pool Study Area
- Vernal Pool Survey Areas
- Helix Vernal Pool Study Area

Survey Results
*** indicates pools >25 square meters**

- Basin with Branchinecta lindahli not present
- Basin with Branchinecta lindahli present
- Vernal pool with Branchinecta lindahli not present
- Vernal pool with Branchinecta lindahli present

0 250 500 Feet

SOURCE: SANDAG, 2016; SanGIS 2016

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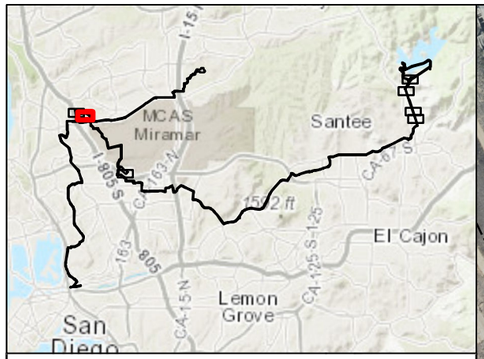
FIGURE 3A
Survey Results Map

2017 Dry Season Survey for Vernal Pool Branchiopods, City of San Diego Pure Water Project, San Diego County, California



LEGEND

- Project Study Area
- San Vicente Pure Water Pipeline (San Vicente Pipeline)
- North City Pure Water Pipeline and San Vicente Pure Water Pipelines
- Moreno Waste Water Forcemain and Brine Line (Morena Pipelines)
- Vernal Pool Study Area
- Vernal Pool Survey Areas
- Helix Vernal Pool Study Area

Survey Results
*** indicates pools >25 square meters**

- Basin with Branchinecta lindahli not present
- Basin with Branchinecta lindahli present
- Vernal pool with Branchinecta lindahli not present

PWP 7
PWP 5
PWP 3
PWP 4
PWP 6
PWP 2
PWP 1*

N

0 250 500 Feet

SOURCE: SANDAG, 2016; SanGIS 2016

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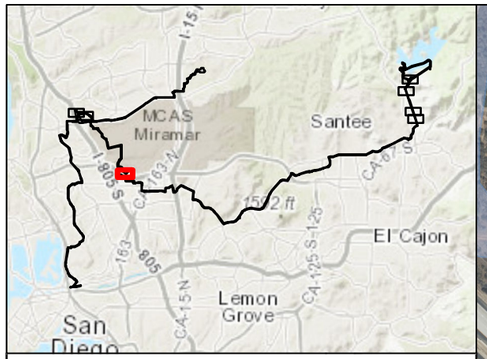
FIGURE 3B
Survey Results Map

2017 Dry Season Survey for Vernal Pool Branchiopods, City of San Diego Pure Water Project, San Diego County, California

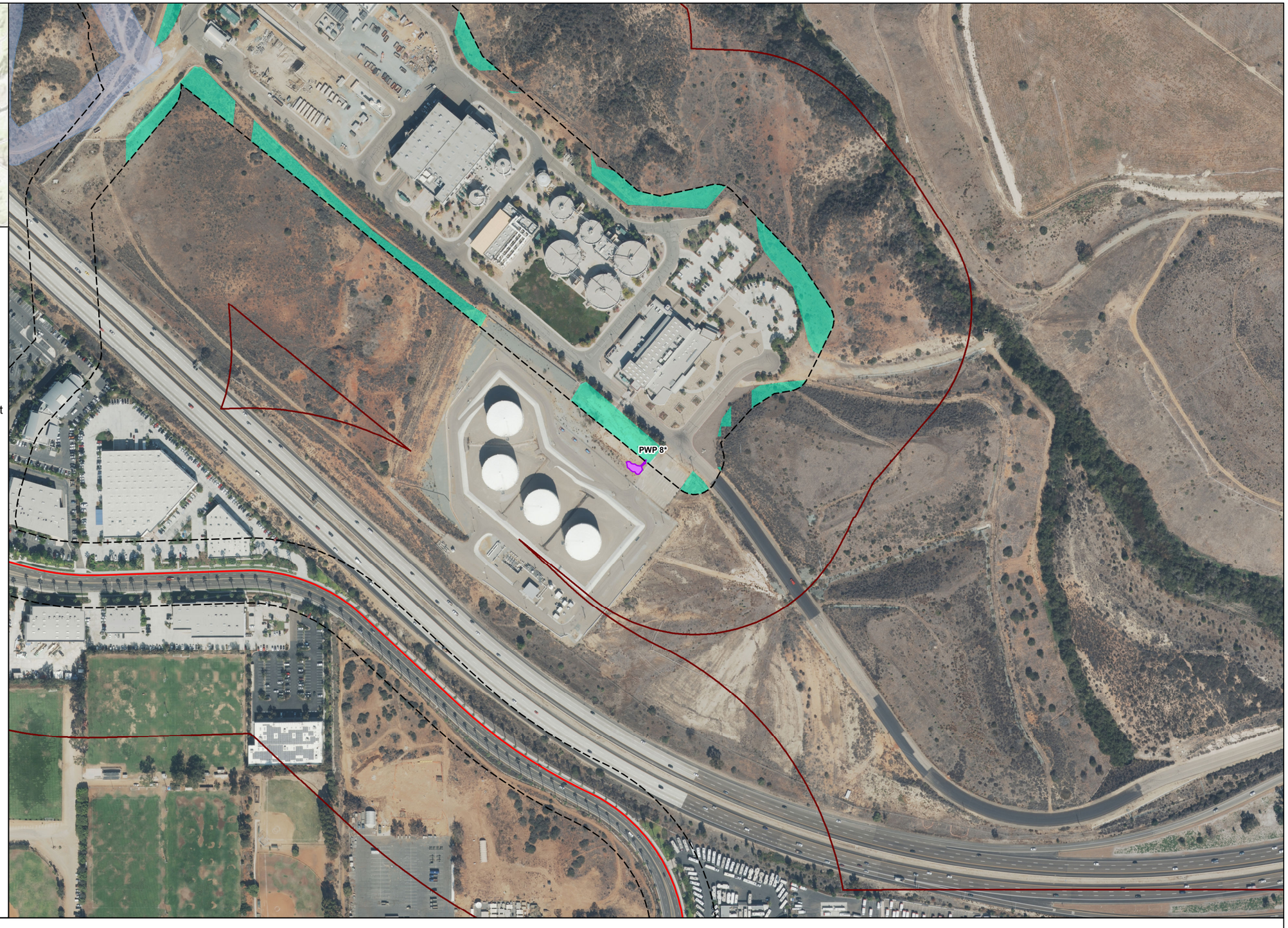


LEGEND

- Project Study Area
- San Vicente Pure Water Pipeline (San Vicente Pipeline)
- Vernal Pool Study Area
- Vernal Pool Survey Areas
- Helix Vernal Pool Study Area

Survey Results
*** indicates pools >25 square meters**

- Vernal pool with Branchinecta lindahli present



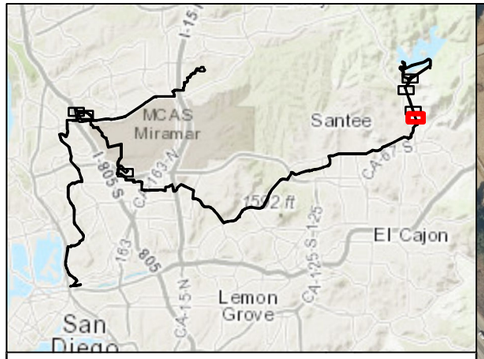
0 250 500 Feet

SOURCE: SANDAG, 2016; SanGIS 2016

DUDEK

FIGURE 3C
Survey Results Map

2017 Dry Season Survey for Vernal Pool Branchiopods, City of San Diego Pure Water Project, San Diego County, California



LEGEND

- Project Study Area
- San Vicente Pure Water Pipeline (San Vicente Pipeline)
- Vernal Pool Study Area
- Vernal Pool Survey Areas

Survey Results
*** indicates pools >25 square meters**

- Basin with Branchinecta lindahli not present
- Basin with Branchinecta lindahli present

PWP 10

PWP 9

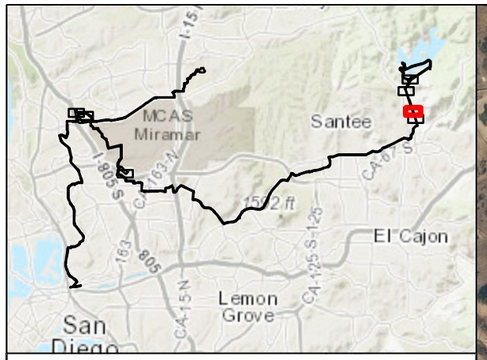
0 250 500 Feet

SOURCE: SANDAG, 2016; SanGIS 2016

DUDEK

FIGURE 3D
Survey Results Map

2017 Dry Season Survey for Vernal Pool Branchiopods, City of San Diego Pure Water Project, San Diego County, California

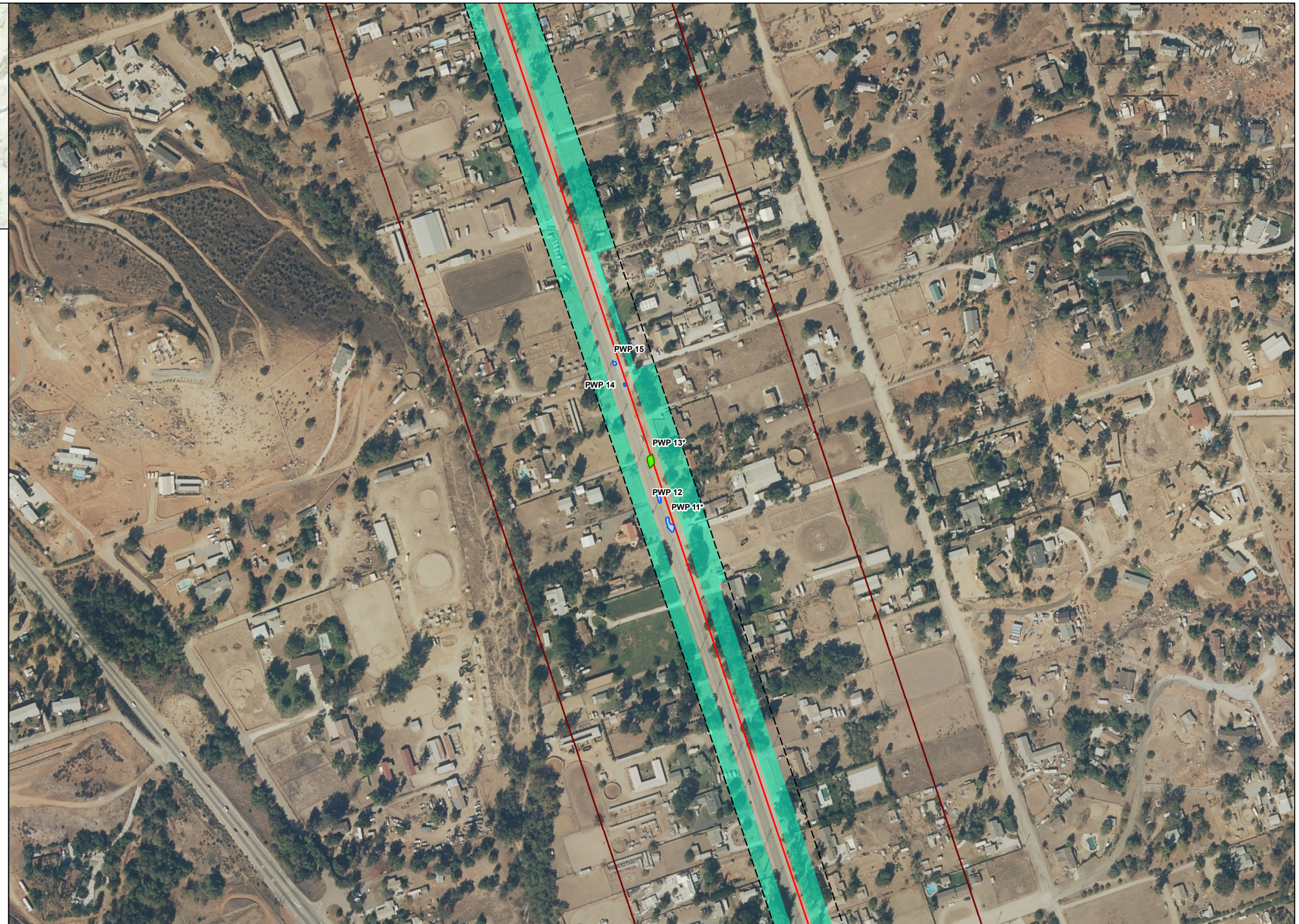


LEGEND

- Project Study Area
- San Vicente Pure Water Pipeline (San Vicente Pipeline)
- Vernal Pool Study Area
- Vernal Pool Survey Areas

Survey Results
*** indicates pools >25 square meters**

- Basin with Branchinecta lindahli present
- Basin with Branchinecta spp.



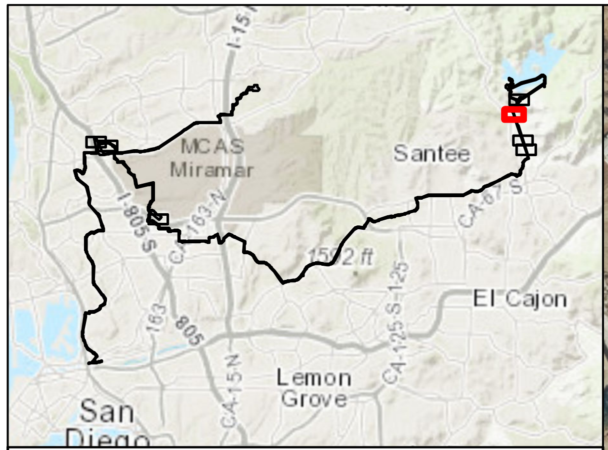
0 250 500 Feet

SOURCE: SANDAG, 2016; SanGIS 2016

DUDEK

FIGURE 3E
Survey Results Map

2017 Dry Season Survey for Vernal Pool Branchiopods, City of San Diego Pure Water Project, San Diego County, California



LEGEND

- Project Study Area
- San Vicente Pure Water Pipeline (San Vicente Pipeline)
- Vernal Pool Study Area
- Vernal Pool Survey Areas

Survey Results
*** indicates pools >25 square meters**

- Basin with Branchinecta lindahli present
- Basin with Branchinecta spp.

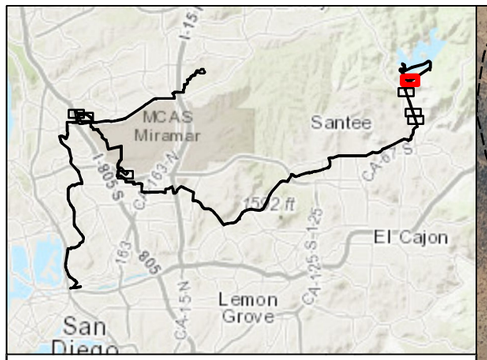
0 250 500 Feet

DUDEK

SOURCE: SANDAG, 2016; SanGIS 2016

FIGURE 3F
Survey Results Map

2017 Dry Season Survey for Vernal Pool Branchiopods, City of San Diego Pure Water Project, San Diego County, California

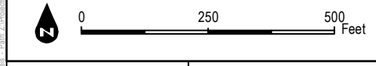


LEGEND

- Project Study Area
- San Vicente Pure Water Pipeline (San Vicente Pipeline)
- San Vicente Pure Water Pipeline - Tunnel Alternative
- San Vicente Pure Water Pipeline - In-Reservoir Alternative
- San Vicente Pure Water Pipeline - Marina Alternative
- Vernal Pool Study Area
- Vernal Pool Survey Areas

Survey Results
*** indicates pools >25 square meters**

- Basin with Branchinecta lindahli not present



SOURCE: SANDAG, 2016; SanGIS 2016

DUDEK

FIGURE 3G
Survey Results Map

2017 Dry Season Survey for Vernal Pool Branchiopods, City of San Diego Pure Water Project, San Diego County, California

APPENDIX A

Survey Data Form

Appendix 2. U.S. Fish and Wildlife Service – Data Sheet for Dry Season Sample Analysis for Listed Large Branchiopods

Project Information

Project Name: Pure Water San Diego
USFWS Project Number:
County: San Diego
Lat: See Report
Long: "

Quad: Several - See Report
Township: "
Range: "
Section: "

Biologist Information

Name of Person(2) Who Conducted the Following Tasks and Permit Number(s):

Soil Collection: Paul Lemons TE051248-5
Soil Processing: Greg Mason TE58862A-0
Soil Analysis/Cysts ID: Greg Mason "
Soil Collection Date: June 9, 2017

Pool/ Habitat/ Basin No.	Invertbrates Present (X)															Comments
	Insect Exo-Skeletons	Micro-Turbellaria Cysts	Cladocera Ephippia	Ostracods Live/Cysts/ Carapaces	Copepods Live/Cysts	Number of Large Branchiopod Cysts: *Branchinecta* sp.	*Lepidurus packardi*	*Streptocephalus wootoni*	*Linderiella occidentalis*	*Lynceus brachyurus*	*Cyzicus californicus*	Hydracarina Live	Nematoda	Collembola	Other Species	
PWP 1																
2																
3						X- 45										BRL1
4						X- 7										BRL1
5						X- 5										BRL1
6																
7																
8						X- 4122										BRL1
9						X- 2										BRL1
10																
11						X- 358										BRL1
12						X- 10										BRL1
13						X- 73										Br. spp
14						X- 1175										BRL1
15						X- 108										BRL1
16						X- 11										Br. spp
17						X- 30										BRL1
18																
19																
VP 5																
8						X - 40										BRL1
10																
11						X - 65										BRL1
12																
15																
17																
18																
19																
26																
29																

APPENDIX B

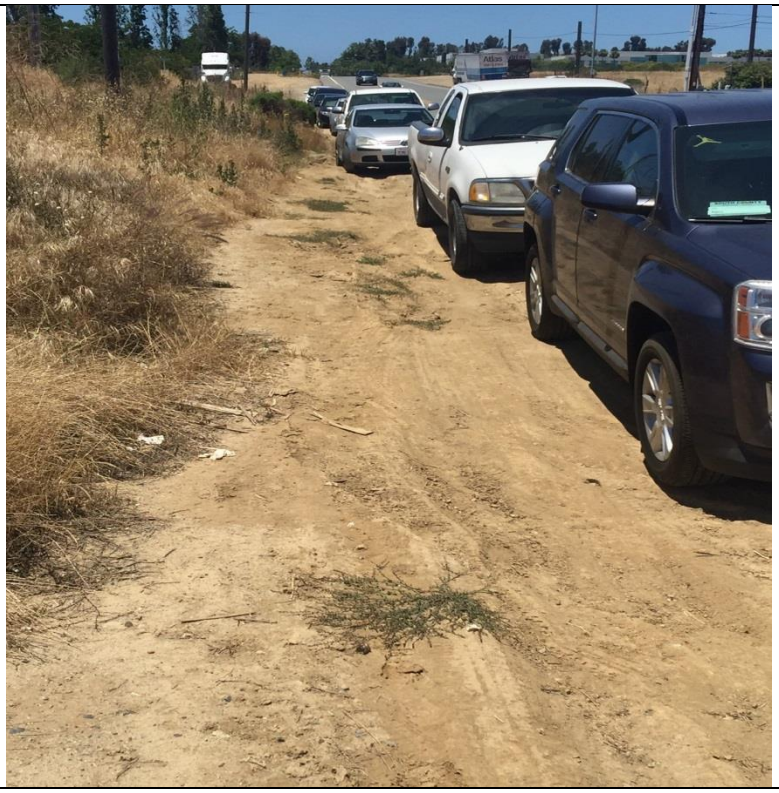
Photo Exhibits

APPENDIX B
Photo Exhibits

Overview photo of vernal pools VP5, VP8, VP10, VP11, VP12, VP15, VP17, VP18, VP19, VP26, and VP27

Photo of vernal pool PWP 1

Photo of road rut PWP 1



Overview photo of road ruts PWP 3 through PWP 7

Photo of vernal pool PWP 8

Overview photos of road ruts PWP 9 through PWP 19

APPENDIX C

Dry Season Fairy Shrimp Sampling Results

ALDEN ENVIRONMENTAL, INC
3245 University Ave, #1188 | San Diego, CA 92104 | **Phone/Fax:** 619.284.3815

July 23, 2017

Mr. Brock Ortega
Dudek
605 Third Street
Encinitas, CA 92024

Subject: Dry Season Fairy Shrimp Sampling Results

Dear Mr. Ortega:

This letter presents the results of dry season sampling conducted on soil samples collected from basins on the Pure Water site.

Methods

Dry Sampling

On Friday, June 9, 2017 Alden received soil samples collected from 30 basins on the Pure Water site. The soil was provided in bags labeled with the basin number. The collected soil from each basin was divided into100ml subsamples, based on the area of the pool and the amount of soil collected. Each sample was then hydrated and processed through a series of sieves to separate out fairy shrimp cysts that may be present. The sieves used were of 710-, 355-, and 212-µm pore size screens. The final sieve pore size is smaller than the target fairy shrimp genera (*Branchinecta* and *Streptocephalus*) average cyst diameter and therefore would retain cysts. The material remaining on the final sieve was next placed in a brine solution to help separate organic from inorganic material. The organic portion was then filtered through a standard coffee filter and allowed to dry. The dried material on the filters was then examined under a stereo dissecting scope to determine if cysts were present. Cyst surface characteristics were then used to identify cysts to genus, if present.

Hatching

Fairy shrimp cysts of the species *Branchinecta* collected during the dry sampling effort were hydrated by placing them into plastic containers, filled with approximately 525 ml of filtered, non-chlorinated drinking water. The coffee filters with the collected cysts were slowly opened over the container and gently shaken to allow the material to fall into the water. The sides of the filter were then rubbed against one another to release any additional material. Finally, a squirt bottle filled with filtered drinking water was used to spray any additional material from the filter into the container.

The containers were given a sample id numbers and placed on a table in a climate controlled room. Lighting in the room was provided by indirect sunlight as well as an overhead light that was kept on approximately 12 hours a day to help emulate spring season lighting conditions. An overhead fan also was kept on at a low level to provide for some air movement across the water surface in the sample containers.

The samples were checked daily to see if any fairy shrimp had emerged. Once nauplii were observed, feeding began. The hatched shrimp were fed a single drop of prepared food on a daily basis until they were collected. The food used was a mix of active brewer's yeast, sugar, powdered fish food, and water.

The hatched shrimp were allowed to continue under these conditions until they had reached maturity, as determined by reaching full size, antennal development (males) and brood pouch (females). Once mature, the fairy shrimp were collected for identification by pouring the material in each container through a small strainer. Collected shrimp were then placed into a dish of carbonated (soda) water to slowly asphyxiate the shrimp. Once dead, the collected shrimp were placed in a 27 x 57 mm (5 dram) clear glass vial, filled with 70% ethyl alcohol. The collected shrimp were then identified to the species level with the aid of a stereo dissecting scope.

Results

Dry Sampling

Of the 30 basins, 14 were found to contain cysts of the genus *Branchinecta* (Table 1). The cyst densities in these 14 basins ranged from 2 to 4,122 cysts per basin. No *Streptocephalus* cysts were recovered from any of the basins.

Hatching

Two rounds of hydration and rearing were conducted for the samples that were found to have cysts present. Following the first round, Lindahl's fairy shrimp were collected and identified in 8 basins (Table 2). Following the second round, Lindahl's fairy shrimp were collected from an additional 5 basins. Only 2 basins (PWP 13 and PWP 16) failed to produce hatched shrimp. No listed San Diego fairy shrimp were identified in either rearing round.

ALDEN ENVIRONMENTAL, INC
3245 University Ave, #1188 | San Diego, CA 92104 | **Phone/Fax:** 619.284.3815

Table 1 **Dry Season Fairy Shrimp Sampling Results**				
Basin	**Volume Collected (ml)**	**Number of Subsamples Processed**	**Fairy Shrimp Cysts Recovered**	
			Branchinecta	***Streptocephalus***
PWP1	2,500	25	0	0
PWP2	1,000	10	0	0
PWP3	1,000	10	45	0
PWP4	1,000	10	7	0
PWP5	1,000	10	5	0
PWP6	1,000	10	0	0
PWP7	1,000	10	0	0
PWP8	2,500	25	4,122	0
PWP9	1,000	10	2	0
PWP10	1,000	10	0	0
PWP11	2,500	25	358	0
PWP12	1,000	10	10	0
PWP13	2,500	25	73	0
PWP14	1,000	10	1,175	0
PWP15	1,000	10	108	0
PWP16	2,500	25	11	0
PWP17	2,500	25	30	0
PWP18	2,500	25	0	0
PWP19	1,000	10	0	0
Total	**29,500**	**295**	**5,946**	**0**
VP5	2,500	25	0	0
VP8	2,500	25	40	0
VP10	1,000	10	0	0
VP11	2,500	25	615	0
VP12	2,500	25	0	0
VP15	1,000	10	0	0
VP17	2,500	25	0	0
VP18	1,000	10	0	0
VP19	2,500	25	0	0
VP26	1,000	10	0	0
VP27	1,000	10	0	0
Total	**20,000**	**200**	**655**	**0**
Combined Total	**49,500**	**495**	**6,601**	**0**

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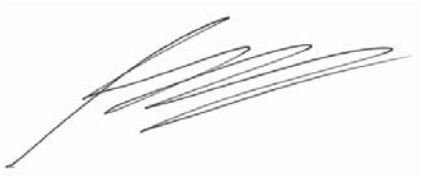
Table 2 **Fairy Shrimp Hatching Results**		
Basin	***Branchinecta lindahli***	
	Male	**Female**
PWP3	3	0
PWP4	0	1
PWP5	3	1
PWP8	5	1
PWP9	6	0
PWP11	15	25
PWP12	3	2
PWP13	0	0
PWP14	20	14
PWP15	4	8
PWP16	0	0
PWP17	5	3
VP8	3	2
VP11	4	2

The above text presents the final results of the dry season fairy shrimp and hatching effort conducted for the project. If you have any questions or need additional information please call.

Sincerely,



Greg Mason
Principal/Senior Biologist