

Memorandum

Date: 30 August 2011

To: Jill Terp, Refuge Manager, San Diego National Wildlife Refuge

From: John Martin, Refuge Biologist, San Diego National Wildlife Refuge

Re: End-of-fiscal year report on status of the Shinohara vernal pool restoration project

The Shinohara vernal pool restoration project, initiated in 2007, continued according to plan in FY 2011. Significant developments in FY 2011 include:

Management actions

A major component of the project-- seeding of pools with federally-listed vernal pool obligate plants -- was initiated this year. On 18 November 2011, we distributed seed of *Pogogyne nudiuscula*, *Eryngium aristulatum* var. *parishii*, *Navaretia fossalis*, and *Orcuttia californica* in selected pools (Figures 1-4). Pools were selected by year of excavation (only 2007 pools, rather than those excavated in 2009) and degree of weed infestation based on monitoring results from the previous two growing seasons. *E. aristulatum* was seeded low in the watershed, because of the species' propensity to grow densely in vernal pools, potentially suppressing growth of other species. In addition to the listed plant species, we also distributed seed of *Epilobium pygmaeum*, *Myosurus minimus* var. *apus*, and *Eleocharis macrostachys*.

An initial site-wide weed control effort was conducted in January 2011. The intent was to control the initial crop of weeds before planting of native plants commenced. A crew from Recon Environmental spot-sprayed weeds with glyphosate, using backpack sprayers and/or truck-mounted hoses. Effectiveness was generally good. However, moderate numbers of broad-leaved weeds (e.g., *Picris echoides*, *Sonchus asper*, *S. oleraceus*, *Brassica nigra*, *Amaranthus albus*, *Solanum americanum*...) germinated after this site-wide spot-spraying sweep. By mid-April, such weeds were approximately 1 m tall. On 19 April, Matt Pecos, Philip Hoover and I spent approximately 3 hours cutting weeds, with the intent of reducing seed set. We cut weeds over 1-2 acres of the 30-acre site. Our overall effectiveness in reducing the number of weed seeds matured and disseminated on the entire site was minimal, because of the relatively small portion of the site treated.

After the initial site-wide herbicide treatment, Recon planted container plants as specified in the Scope of Work (Table 1). Planting began approximately 24 January 2011, and continued until 16 March 2011. Irrigation of the planted stock will continue into September.

Table 1. Species and quantities of container plants planted at Shinohara vernal pool restoration site, San Diego National Wildlife Refuge, Jamul, California, in 2011.

Species	quantity
<u>Shrubs- one gallons</u>	
<i>Adolphia californica</i>	200
<i>Artemisia californica</i>	1,000
<i>Astragalus trichopodus</i>	200
<i>Eriogonum fasciculatum</i>	1,000
<i>Eriophyllum confertiflorum</i>	200
<i>Grindelia camporum</i>	50
<i>Mirabilis californica</i>	200
<i>Salvia apiana</i>	200
<i>Solanum parishii</i>	50 (original order called for 100, 50 <i>Grindelia camporum</i> and 50 <i>Solanum parishii</i> installed as substitutes)
<i>Viguiera laciniata</i>	500
<u>Grasses- rose pots</u>	
<i>Achnatherum diegoensis</i>	500
<i>Melica imperfecta</i>	1,000
<i>Muhlenbergia microsperma</i>	1,000
<i>Muhlenbergia rigens</i>	500

<i>Nassella pulchra</i>	20,000
<i>Sisyrinchium bellum</i>	2,000
<i>Sporobolus airoides</i>	500
<u>Bulbs</u>	
<i>Allium haematochiton</i>	768
<i>Allium preacox</i>	4,848
<i>Bloomeria crocea</i>	1,536
<i>Chlorogalum parviflorum</i>	3,000
<i>Dichelostemma capitatum</i>	450

Monitoring

On 3-4 January, I conducted surveys for endangered San Diego fairy shrimp (*Branchinecta sandiegonensis*). I used a sweep-net to sample the pools from which San Diego fairy shrimp had not already been documented (51 of the 64 pools on the site). Shrimp were detected in 13 of the 51 pools sampled, bringing the total number of pools on-site known to support shrimp to 27. All specimens collected were positively identified as *B. sandiegonensis* by volunteer Lisa Allen, who holds a 10(a)(1)(A) ESA permit to conduct surveys for endangered San Diego fairy shrimp. Voucher specimens are in the collection of the San Diego Natural History Museum and SDNWR.

On 30 June, I monitored the plant community using point-intercept methodology on ten permanent transects that I had established in 2008.

On 17 August, I surveyed all pools for the federally listed plant species that we had direct-seeded on the site on 18 November. I found *Pogogyne nudiuscula* in nine pools, *Eryngium aristulatum* var. *parishii* in two pools, *Navarretia fossalis* in three pools, and *Orcuttia californica* in one pool.

Status

Overall, much progress has been made toward restoration of native flora and fauna of the vernal pools, and the interstitial grassland and coastal sage scrub. The abundance and distribution of San Diego fairy shrimp continues to expand. Abundance of Otay tarplant (*Deinandra conjugens*) has increased approximately a hundred-fold. Burrowing owls (*Athene cunicularia*) continue to occupy the site. Some components of cryptobiotic crusts (primarily mosses) are becoming established on areas of bare soil. Other sensitive species that have benefitted from the restoration and now occupy the site include several California Species of Special Concern (California Department of Fish and Game 2011): loggerhead shrike (*Lanius ludovicianus*: a juvenile of which has been seen at least twice in post-breeding season 2011) Hammond's spadefoot toad (*Spea hammondi*: larvae of which were observed in pool #12 on 20 April 2011), San Diego black-tailed jackrabbit (*Lepus californicus bennettii*: I have seen them on the site on virtually every visit in 2011), San Diego ring-necked snake (*Diadophis punctatus similis*), northern harrier (*Circus cyaneus*: forages frequently on the site), San Diego cactus wren (*Campylorhynchus brunneicapillus sandieguensis*: a dispersing juvenile was seen on the site on 17 August 2011), and California gnatcatcher (*Poliophtila californica*).

The direct-seeding of federally-listed vernal pool obligate plants was moderately successful. All four species occurred in all of the pools that were seeded, except *O. californica*, which only was found in one of the four seeded pools. Only one individual *O. californica* was found. I covered this plant with a chicken-wire barrier to protect it from herbivory by rabbits. *P. nudiusscula* grew especially well, with some pools supporting between 50-100 plants. We had abundant seed of *P. nudiusscula*, and therefore introduced it in several pools. In contrast, we had relatively little seed of *N. fossalis*, and observed relatively few plants in the pools where it occurred. Germination of obligate vernal pool plants in the first year after seeding does not necessarily reflect the likelihood of final establishment (Mark Doderer, Recon Environmental, pers. comm.). Seeds may remain dormant in the soil for years until suitable climatic conditions stimulate them to germinate and grow.

Management recommendations

1. Continue to control weeds site-wide. Five years of diligent weed control have greatly decreased the abundance of exotic annuals in general, and have virtually eliminated exotic annual grasses. However, the reduced competition associated with the removal of grasses has enabled some species of broadleaf weeds (e.g., *Picris echoides*, *Salsola tragus*, *Conyza canadensis*, *Lythrum hyssopifolium*, *Amaranthus albus*, *Sonchus oleraceus*, *Solanum americanum*, *Rumex crispus*, and *Hirschfeldia incanica*) to proliferate on the site. If allowed to proliferate, these weeds have the potential to degrade habitat quality for many of the federally-listed species and sensitive species listed above. Now that weeds are less abundant, it may be feasible to use a different approach, that is less costly and entails less potential impact from herbicides. I would like to investigate the potential to manually control weeds, either digging them up with a hoe, or by cutting off flowering stalks with a brush cutter and thus reducing seed production.

2. Manually control weeds within pool basins. Virtually all of the pools on the site harbor *Lythrum hysopifolium*. This exotic species can 50-100% cover the pool basin, and suppress growth and seed production of the federally-listed vernal pool obligate species that are the primary target of our restoration effort. This species can likely be effectively controlled by diligent use of a long-handled hoe, which enables a person to access the weeds without walking on the mud of the pool basin and disrupting its ecology. Pools supporting listed plant species should be given higher priority for weed control.
3. Control tarplant (*Deinandra* sp.). Otay tarplant and fascicled tarplant (*D. fasciculata*) are native species, and have not been controlled by our weed management efforts. They have greatly increased in abundance, and are likely degrading habitat quality and interfering with the continued development of a diverse restored native vernal pool/grassland/CSS community. Burrowing owls are considerably less abundant on the site now than they were prior to the proliferation of tarplant, and it is likely that the visual obstruction of abundant tarplant 1 m tall interferes with foraging and predator detection, and makes owls less likely to remain on the site. The thick stands of tarplant provide good cover for rabbits, and have contributed to an elevated population of desert cottontails (*Sylvilagus auduboni*). The elevated rabbit population may attract raptors that potentially prey on burrowing owls. The rabbits also eat native plants that we're trying to establish, especially perennial bunchgrasses. The majority of the grass plugs that Recon has planted in 2011 have been heavily grazed by rabbits. It remains to be seen what proportion of those grasses will survive in the next growing season, but it is likely that thousands have been killed outright. Tarplant may be reduced in abundance by removing the mature plants before they drop seed. At this stage, the two species can be distinguished by the degree of openness of the inflorescence, and Otay tarplant can be retained in clay-soil areas of the site, while removing problematic stands of fascicled tarplant.

Literature cited

California Department of Fish and Game. 2011. Special Animals List.
<http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/SPAnimals.pdf>

Figure 1. Pools where *Pogogyne nudiuscula* was direct-seeded on 18 November, 2011, on San Diego National Wildlife Refuge, Jamul, California. Yellow indicates seeded pools.

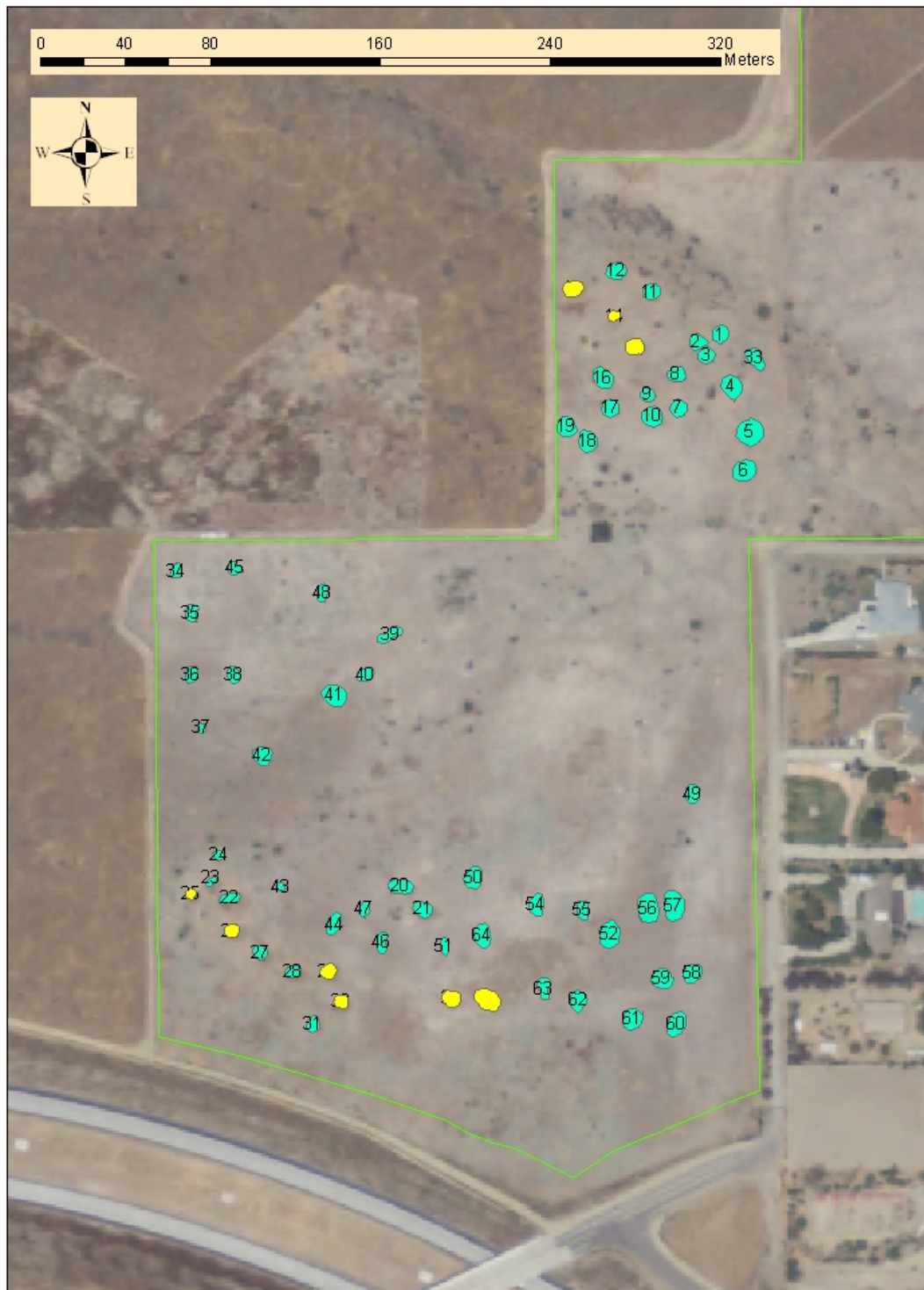
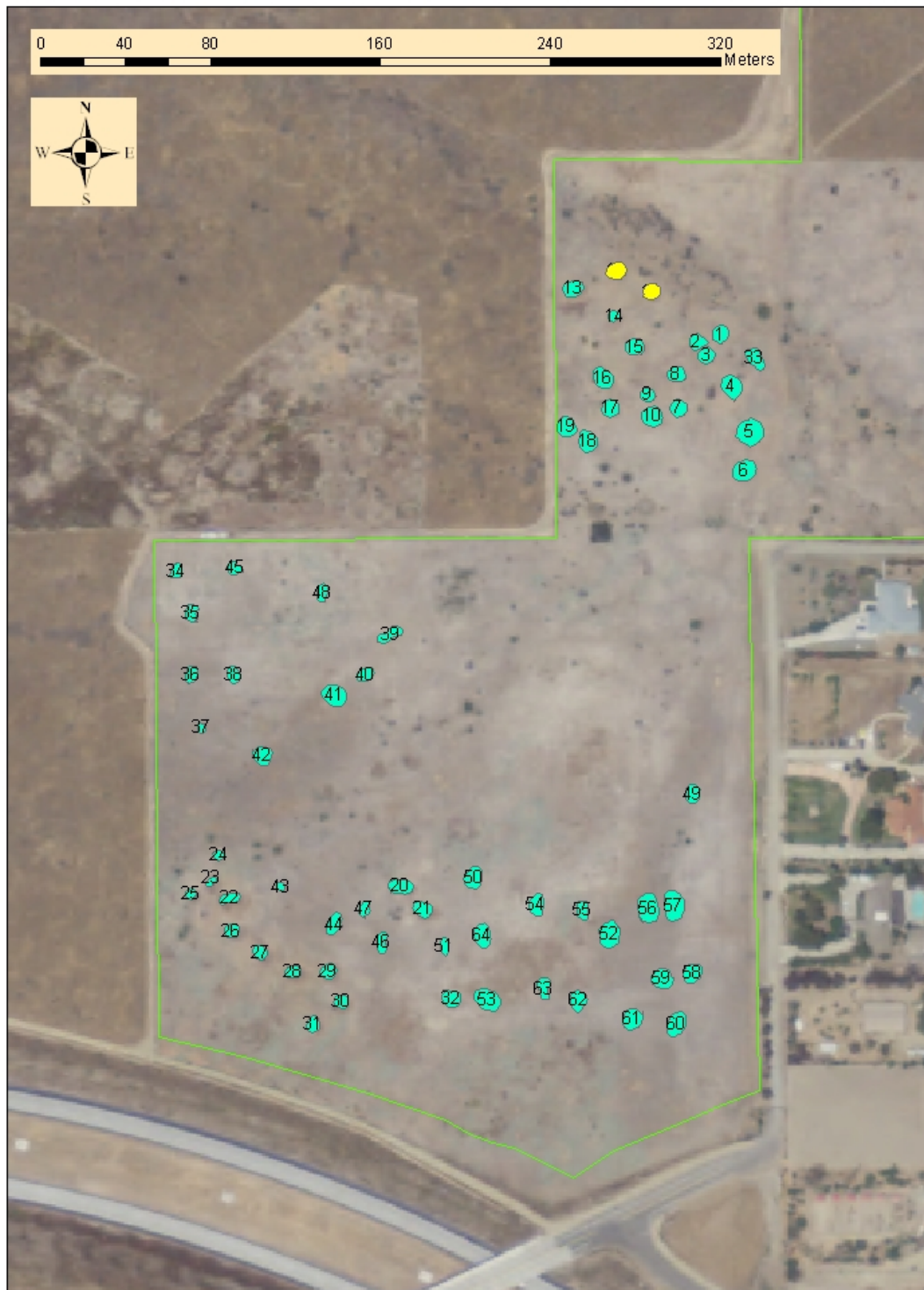


Figure 2. Pools where *Eryngium aristulatum* var. *parishii* was direct-seeded on 18 November, 2011, on San Diego National Wildlife Refuge, Jamul, California. Yellow indicates seeded pools.



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Figure 4. Pools where *Navarretia fossalis* was direct-seeded on 18 November, 2011, on San Diego National Wildlife Refuge, Jamul, California. Yellow indicates seeded pools.

