TO: Implementation Board

FROM: Matthew Fogarty, Senior Land Management and Monitoring Specialist

SUBJECT: Professional Services Agreement with Creekside Science and Resolution Accepting California Department of Fish and Wildlife Local Assistance Grant Funding to Complete the *Tiburon Paintbrush (Castilleja affinis ssp. neglecta): Genetic Characterization and Seeding Trials to Support Population Expansion Project.*

RECOMMENDED ACTIONS:

A. Authorize the Executive Officer to execute a not-to-exceed $79,250 Professional Services Agreement with Creekside Science to complete the *Tiburon Paintbrush (Castilleja affinis ssp. neglecta): Genetic Characterization and Seeding Trials to Support Population Expansion Project* (Project).

B. Adopt a resolution accepting a grant award from California Department of Fish and Wildlife (CDFW) and entering into a grant agreement with CDFW for a Local Assistance Grant (LAG) for the Project in the amount of $79,998 (Attachment A – Resolution). Appoint the Executive Officer or designee as agent for the Santa Clara Valley Habitat Agency to ensure all grant-related tasks for the aforementioned project are completed.

BACKGROUND: In January 2024, the Habitat Agency acquired 944 acres of the +/- 3,650-acre Richmond Ranch Property in the Diablo Foothills. Subsequently, the Habitat Agency contracted with Creekside Science (Creekside) to perform baseline botanical and Bay checkerspot butterfly surveys. Creekside is a biological consulting firm on the Habitat Agency's On-Call list. Their biologists are among the foremost experts on serpentine grassland ecology in the Santa Clara Valley.

During baseline botanical surveys, Creekside discovered a previously undocumented population of Tiburon paintbrush (*Castilleja affinis* ssp*. neglecta).* Prior to this discovery, the plant was only known to occur in 7 discrete locations throughout the San Francisco Bay Area (2 of which are in Santa Clara County). Tiburon paintbrush is a covered species under the Santa Clara Valley Habitat Plan. As such, the Habitat Plan calls for targeted studies to successfully manage the populations of this species that are enrolled in the Reserve System:

- Studies-5: Targeted studies will be conducted to identify factors limiting expansion. These studies may focus on various factors related to management and microsite needs of the species at all life stages from germination through maturity.
- Studies-16: Additional studies to determine the effects of livestock grazing on Tiburon paintbrush.

Across its range, Tiburon paintbrush exhibits a large degree of fluctuation in the number of mature plants per year, leaving it susceptible to stochastic events that are expected to become more prevalent with climate change. Discovery of the new Richmond Ranch population (which contains approximately 167 individuals) precipitates an urgent need for the Habitat Agency to: (A) characterize this taxon using cutting-edge genomics, and (B) explore management strategies that may facilitate population resilience, growth and recovery.

The Habitat Agency developed a Project titled, "*Tiburon Paintbrush (Castilleja affinis ssp. neglecta): Genetic Characterization and Seeding Trials to Support Population Expansion*." The Project seeks to accomplish the following:

1. Establish best practices for nursery seed production of Tiburon paintbrush and produce at least 100,000 seeds annually.
2. Conduct wild seeding and germination trials to facilitate population growth to 2,000 individuals at the Paintbrush Canyon population.
3. Characterize genetics of Tiburon paintbrush across its range.
4. Evaluate impacts of herbivory and pig rooting on the Richmond Ranch population.
5. Leverage insights gathered to develop a management and enhancement plan for the newly discovered Richmond Ranch population.

Meeting these objectives will help develop strategies to expand populations of Tiburon Paintbrush advancing efforts to meet goals and objectives described in both the Habitat Plan and the United States Fish and Wildlife Service (USFWS) 1998 Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area.

The team that will implement the Project includes the Habitat Agency, Creekside Science and Sarah Jacobs PhD (Assistant Curator of Botany and Howell Chair of Western North America Botany at the California Academy of Sciences). Dr. Jacobs runs a research lab that studies plant systematics and speciation. Her particular focus is the genus, *Castilleja.* Creekside Science will lead seeding trials and nursery production on the project (Attachment B: Creekside Science Scope of Work), while Dr. Jacobs will lead genetic characterization (Attachment C: Cal Academy Scope of Work).

On September 25, 2024, the Habitat Agency was awarded a $79,998 grant from the California Department of Fish and Wildlife (CDFW) to complete the Project (Attachment D: CDFW Grant Award). CDFW requires an adopted board resolution to receive grant funds before a payable grant agreement can be executed.

FISCAL IMPACT: The total project cost will not exceed $226,886. CDFW has awarded the Habitat Agency $79,998 in funding. Creekside will contribute a $122,158 in-kind match (ongoing work in Santa Clara Valley). Dr. Sarah Jacobs and the California Academy of Sciences will contribute a $9,360 in-kind match.

The total cost incurred by the Habitat Agency will be $15,370. This includes a $10,000 cash match and $5,370 in staff time.

ATTACHMENTS:
Attachment A – Resolution
Attachment B – Creekside Science Scope of Work
Attachment C – Cal Academy Scope of Work
Attachment D – CDFW Grant Award

ATTACHMENT A

Resolution

RESOLUTION NO. I-2024-____

RESOLUTION OF THE IMPLEMENTATION BOARD OF THE SANTA CLARA VALLEY HABITAT AGENCY (GRANTEE) AUTHORIZING THE APPLICATION AND ACCEPTANCE OF GRANT FUNDS FOR THE NATURAL COMMUNITY CONSERVATION PLANNING (NCCP) LOCAL ASSISTANCE GRANT (LAG) (FY24-25) TIBURON PAINTBRUSH (*CASTILLEJA AFFINIS* SSP. *NEGLECTA*): GENETIC CHARACTERIZATION AND SEEDING TRIALS TO SUPPORT POPULATION EXPANSIONPROJECT

WHEREAS, certain NCCP LAG grant funds are made available annually on a competitive basis by the California Department of Fish and Wildlife (CDFW) for NCCP Programs highest priority implementation tasks; and

WHEREAS, the grants are awarded pursuant to guidelines established by the CDFW for determination of project eligibility for funds; and

WHEREAS, procedures established by the CDFW require the Grantee to certify by resolution the approval to apply for, and accept, grant funds and provide authorization to enter into an agreement with the CDFW to implement high priority activities related to the NCCP Program; and

WHEREAS, Grantee submitted a proposal for financial assistance to implement the project titled Tiburon Paintbrush (*Castilleja affinis* ssp. *neglecta*): Genetic Characterization and Seeding Trials to Support Population Expansion (Project). The Project will characterize populations of Tiburon paintbrush using cutting edge genomics and explore management strategies that may facilitate population expansion in the Habitat Agency Reserve System; and

WHEREAS, total Project cost is anticipated to be $226,886; funding is from the CDFW in the amount of $79,998.

NOW, THEREFORE, BE IT RESOLVED that the Implementation Board of the Santa Clara Valley Habitat Agency approves the filing of the application for NCCP LAG funding for the Project in the amount of $79,998 and accepts the grant awarded.

BE IT FURTHER RESOLVED that the Implementation Board of the Santa Clara Valley Habitat Agency appoints its Executive Officer, or designee, as agent to conduct all negotiations, execute and submit all documents including, but not limited to, applications, agreements, payment requests and so on, which may be necessary for the completion of the aforementioned project(s).

ADOPTED by the Implementation Board of the Santa Clara Valley Habitat Agency on November 21, 2024, by the following vote:

AYES:

NOES:

ABSENT:

ABSTAIN:

JENNIFER CARMAN
Chair, Implementation Board
Santa Clara Valley Habitat Agency

ATTEST:

KIM MANCERA
Deputy Secretary
Santa Clara Valley Habitat Agency

I HEREBY CERTIFY that the foregoing resolution was adopted at a regular meeting of the Implementation Board of the Santa Clara Valley Habitat Agency, duly noticed and held according to law, on November 21, 2024.

Date: _____

EDMUND SULLIVAN

Executive Officer
Santa Clara Valley Habitat Agency

ATTACHMENT B

Creekside Science Scope of Work

CREEKSIDE SCIENCE
P.O. BOX 1553, LOS GATOS, CA 95031

Christal Niederer, Senior Biologist
650 867 7841; christal@creeksidescience.com

July 19, 2024

Matthew Fogarty
Senior Land Management and Monitoring Specialist
Santa Clara Valley Habitat Agency
535 Alkire Ave., Suite 100
Morgan Hill, CA 95037

Re: Tiburon Paintbrush: Population Genetics and Propagation Studies to Inform Future Population Expansion and Species Recovery, CDFW LAG grant proposal

Dear Mr. Fogarty,

Thank you for your interest in having Creekside Science collaborate with you on the CDFW LAG proposal for continuing work on Tiburon Paintbrush.

We consider Creekside Science to be extremely well-positioned to conduct the suggested tasks. As you know, we have conducted seeding and monitoring for this taxon for more than a decade and have the capacity to produce 100,000+ seeds annually in the Creekside Science Conservation Nursery. This project leverages more than a decade of completed research and monitoring.

Below please find our proposed tasks, costs, and timeline. Our total for the project is $201,408. We will be supplying $122,158 inkind funding ($117,678 from existing vegetation composition monitoring contracts from multiple agencies, and $4480 for an early seeding effort funded by Dr. Weiss), so we will be asking for **$79,250** in funding from this grant.

Thank you again for the opportunity to submit this proposal. Please don't hesitate to ask if you have any more questions.

Sincerely,

Christal Niederer

Senior Biologist

Task	Chief scientist hours	Staff scientist hours	Supplies/ Services	Total	CDFW LAG grant	Creekside Science in kind
Hourly rate	220	140				
Task 2: Install seed in wild		32		$ 4,480		$ 4,480
Task 3: Propagate Castilleja and host plants, including maintaining existing plants		64		$ 8,960	$ 8,960	
Task 4: Collect regional vegetation composition data to inform seeding trials			58020	$ 58,020		$ 58,020
Task 5: Install wildlife cams at Richmond Ranch, maintain through August, review photos		40	695	$ 6,295	$ 6,295	
Task 6: Collect genetic material from all sites, prep work		32		$ 4,480	$ 4,480	
Task 7: Collect 5 soil samples from Richmond Ranch, run at $135/sample		8	$ 675	$ 1,795	$ 1,795	
Task 3: Collect, clean, and process nursery seed		20		$ 2,800	$ 2,800	
Task 3: Collect wild seed		8		$ 1,120	$ 1,120	
Task 2: Install seed in wild		32		$ 4,480	$ 4,480	
Task 8: Data analysis	8	8		$ 2,880	$ 2,880	
Task 8: Reporting	8	16		$ 4,000	$ 4,000	
TOTAL $	16	228	$ 59,390	$ 99,310	$ 36,810	$ 62,500

2026

	Chief scientist hours	Staff scientist hours	Supplies/ Services	Total	CDFW LAG grant	Creekside Science in kind
Hourly rate	225	145				
Task 3: Propagate Castilleja and host plants, including maintaining existing plants		64		$ 9,280	$ 9,280	
Task 4: Collect regional vegetation composition data to inform seeding trials			$ 59,658	$ 59,658		$ 59,658
Task 2: Monitor old plots, macroplot (56 hrs), and Jan. 2025 seeded plots (16), Richmond population (16)		88		$ 12,760	$ 12,760	
Task 3: Collect, clean, and process nursery seed		20		$ 2,900	$ 2,900	
Task 2: Collect wild seed		8		$ 1,160	$ 1,160	
Task 1: Seed in wild, best treatments plus control		32		$ 4,640	$ 4,640	
TOTAL $	0	212	$ 59,658	$ 90,398	$ 30,740	$ 59,658

2027

	Chief scientist hours	Staff scientist hours	Supplies/ Services	Total	CDFW LAG grant	Creekside Science in kind
Hourly rate	230	150				
Task 8: Data analysis	16	16		$ 6,080	$ 6,080	
Task 8: Reporting	14	16		$ 5,620	$ 5,620	
TOTAL $	30	32	$ -	$ 11,700	$ 11,700	$ -

Supplies are further broken down:

Task 5: wildlife cams: Three Browning recon force elite wildlife cameras at $170 each = $510. 6 SDXC class 10 memory cards at $30 each = $150, $20 for 3 t-posts, $10 for camera batteries, $5 for zip ties.

Task 7 Collect soil samples: 5 samples at $135/sample = $675.

ATTACHMENT C

Cal Academy Scope of Work

July 4, 2024

Santa Clara Valley Habitat Agency
535 Alkire Avenue, Suite 100
Morgan Hill, CA 96037

RE: Statement of Work for Tiburon Paintbrush Genetic Research

Dear Mr. Fogarty,

Thank you for your interest in collaborating on a proposal for CDFW's Local Assistance Grant Program. Please find attached a statement of qualifications, scope of work, and cost estimate for the genetic research component of the Project.

As you know, I have been spearheading a *Castilleja* research program at the California Academy of Sciences. The costs of genomic analyses are highly leveraged against my ongoing work. Most importantly, the base work of building the genome is done and ready to import new sequence data from Tiburon paintbrush.

The costs directly funded in this grant correspond to the actual sequencing only. We will provide sampling, lab analysis, interpretation, and write up time as an in-kind match for the project.

Best,

Sarah J. Jacobs, PhD

Assistant Curator of Botany
Howell Chair of Western North American Botany
California Academy of Sciences

Description of Ongoing Research:

Research in the Jacobs lab is geared towards understanding how new species of Castilleja are formed. To do this work, Dr. Jacobs collects large datasets of morphological, ecological, and genetic data to reconstruct the evolutionary history of the genus. Once that evolutionary hypothesis is in place, she maps traits (e.g. morphological, biotic, abiotic) on the phylogeny to describe the correlates of diversification events. Collaboration with the Jacobs lab at the California Academy of Sciences would enable detailed population genetic research using advanced molecular techniques to describe the genetic diversity and population structure of the polyploid Castilleja affinis variety neglecta. In addition, this data will be useful for detecting and describing gene flow between C. affinis var. neglecta and other co-occuring species of Castilleja. This information is pertinent to conservation and management efforts of this endangered taxon. In addition, data collected as part of this project will be incorporated into the datasets Dr. Jacobs is currently building as part of her work in the Coastal California Castilleja species complex and, more broadly, the genus.

Background:

Castilleja affinis variety neglecta is a hemiparasitic plant (meaning it is autotrophic - capable of photosynthesis - and parasitic - capable of forming haustorial connections to derive nutrition from a host) in the largely parasitic family Orobanchaceae. It is endemic to Marin, Napa, and Santa Clara counties in California, considered federally endangered and state threatened, and is the only member of the species Castilleja affinis that is found on serpentine substrates. Because of its rare/threatened status and its occurrence on serpentine soils, this taxon falls under U.S. Fish and Wildlife Service's 1998 Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area (Recovery Plan) and the Santa Clara Valley Habitat Plan (ICF 2012). These two plans call for targeted studies to determine factors limiting the expansion of the covered plant species, including but not limited to its management and micro-site needs, and the implementation of measures to mitigate or eliminate these factors to promote occurrence expansion.

This taxon is also part of the Coastal California Castilleja species complex, a group of coastal perennial Castilleja species that are highly morphologically variable, likely exchanging genes when they co-occur, and subsequently experiencing especially high taxonomic confusion. In short, they are in need of comprehensive genetic and morphological study to determine species boundaries. This information is, of course, important to management and conservation questions and strategies. This complex additionally provides an excellent opportunity to study processes associated with the early stages of speciation (particularly speciation with gene flow), as well as the role of polyploidy and the environment in diversification.

Methods:

Jacobs lab fieldwork elements would include field visits in collaboration with Creekside Science to known populations of Castilleja affinis var. neglecta. At each site, up to ten individuals of appropriate age and maturity (i.e. well established, robust individuals with (preferably) multiple stems) would be selected for morphological and genetic data collection. Each individual will have three leaves and three flowers removed, dissected (separating the bract, calyx, corolla), and

scanned using a digital flatbed scanner to digitally preserve each organ for linear measurement at a later date. The dissected leaves and flowers will then be placed in a tea bag with silica gel to rapidly dessicate the tissue for later DNA extraction in the lab and ploidy estimation with flow cytometry. At each population, one individual will be vouchered and deposited at the CAS herbarium (i.e. dried, pressed and turned into a research specimen).

Methodological approaches for genetic analysis include DNA extraction using Qiagen DNeasy Plant Pro extraction kits. This will be followed by double digest, restriction site-associated DNA sequencing (ddRAD sequencing) which will produce many loci that are randomly scattered throughout the genome. This sequencing approach is useful at the population level (to understand levels of genetic diversity across populations) as well as across species and genera (to infer the closest evolutionary relatives to C. affinis). The number of genome copies in each individual (e.g., "ploidy") will be estimated via flow cytometry. Sequencing that accommodates the multiple copies of the genome will be performed using a NovaSeq X Plus 25B flow cell, one of the newest sequencing techniques that increases efficiency and, subsequently, cost.

Morphological measurements of floral organs and leaf tissue will be performed on the scans made in the field using the software ImageJ. These will be analyzed using custom Jacobs lab scripts that will identify morphological similarities and differences among individuals and populations of C. affinis var. neglecta and other members of the Coastal California Castilleja complex. This data will be used to better understand morphological variation within and across the species. Ecological data, extracted from climate and soil databases using the coordinates of each population, will be similarly used to characterize and measure the ecological preferences for the species.

Once generated, sequence data will be cleaned, filtered and assembled into final datasets using the software iPyrad and vcftools. Phylogenies (graphs illustrating evolutionary relationships of individuals) will be inferred using IQtree and bootstraps, gene and site concordance statistics will be calculated to describe topological support. Genetic similarity matrices will be created and used to assess population structure (with UPGMA trees, principal coordinates analysis, STRUCTURE and isolation by distance plots) and characterize genetic diversity within each population (by calculating summary statistics). Gene flow between populations will also be estimated (via ABBA/BABA test and using network analyses). Finally, utilizing genomic resources available in the Jacobs lab, outlier and GxE (genome by environment) analyses will be performed to identify unique/outlier alleles associated with environmental characteristics of each population.

Deliverables:

Products of this research will include data collected for ~100 individuals (10 individuals each from ten populations of C. affinis variety neglecta from across its known range) reflecting variation in their genomes, phenomes, and ecological preferences. These data will be invaluable for efforts aimed at characterizing genetic diversity of Castilleja affinis variety neglect populations, as well as reconstructing the phylogeny of Castilleja. Data from this project (DNA

sequence data and morphological measurement data) will be uploaded to public databases and voucher collections will be accessioned at the California Academy of Sciences Herbarium [CAS].

In addition to reports and other products associated with this project, data generated as part of this study will also contribute to the phylogenetic inference and publication of a genus-wide phylogeny, as well as manuscripts aimed at disentangling relationships in the Coastal California Castilleja specie complex (of which Castilleja affinis variety neglecta is a member). These data will be published in the scientific literature and results of the study will be further communicated to the broader scientific community at professional conferences and the general public through science communication talks associated with the museum. Collaboration with Creekside Science, as well as acknowledgment of funding sources, will be clearly and explicitly identified.

Budget:

Approximate budget for molecular work and specimen vouchering - $10,548.00

In-kind contribution - e.g. Dr. Jacobs' time, computational resources at CAS, etc. - $9,360.00

Total budget - <u>$19,908.00</u>

<u>Molecular data = $10,548.00</u>

DNA extraction and library preparation: $45.50 per sample * 100 individuals = $4,550.00

DNA sequencing: ~$2,749.00 for one lane of NovaSeq x Plus 25B which would sequence 50 hexaploid individuals = $5,498.00 (two lanes for 100 individuals)

Wet lab consumables, including plastics, reagents, dyes, chemicals: $5 per sample * 100 individuals = $500.00
Sampling (16 hrs), lab work (20 hrs), data analysis (40 hrs), interpretation (40 hrs), and project <u>write-up (40 hrs) = $9,360.00</u>

time: $60/hour * 156 hours = $9,360.00

<u>Vouchering collections = $200.00</u>

Curation of vouchered specimens (includes products (mounting paper, glue, etc) and staff time to prepare, process, and curate specimens): $20.00 per specimen * ~10 specimens = $200.00

Exhibit C: Photographs

Photo 1: Serpentine bunchgrass grassland at Richmond Ranch

Photo 2: New population of Tiburon paintbrush at Richmond Ranch

ATTACHMENT D

CDFW Grant Award

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Habitat Conservation Planning Branch
P.O. Box 944209
Sacramento, CA 94244-2090
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

September 25, 2024

Matthew Fogarty
Senior Land Management and Monitoring Specialist
Santa Clara Valley Habitat Agency
535 Alkire Avenue, Suite 100 Morgan Hill, CA 95037
matthew.fogarty@scv-habitatagency.org

FY24-25 LAG Grant Proposal Notification

Dear Mr. Fogarty:

We are pleased to inform you that the California Department of Fish and Wildlife (CDFW) has selected your proposal entitled Tiburon Paintbrush (Castilleja affinis ssp. neglecta): Genetic Characterization and Seeding Trials to Support Population Expansion to receive Natural Community Conservation Planning (NCCP) LAG funds for high priority tasks needed to implement the Santa Clara Valley HCP/NCCP. The proposal you have submitted will further our knowledge of conservation planning and enhance our efforts to conserve species and habitats.

You have been awarded a total of $79,998. To expedite the grant process, please provide the following forms to the CDFW regional grant manager, Craig Weightman, as soon as possible to finalize the grant scope of work (see Appendix B on page 24 of the FY 24/25 Proposal Solicitation Package).

1. STD. 19, 21 and 204 - if not already provided under a previous Grant Agreement
2. Federal Taxpayer ID number and 501(c)(3) Certification (for non-profit organizations)
3. If your organization is a public entity, such as a Resource Conservation District, city, county, district, joint powers authority, etc., that has a governing body, a resolution of project approval from the governing body will be required to enter into an agreement. The authorizing resolution from your governing body needs to confirm its approval of the specific project and specific award amount shown above.

Please note the following:

- A Grant Agreement must fully be executed in the current fiscal year, or this grant award will be null and void. Please coordinate with the CDFW regional grant manager for fiscal year end deadlines.
- Billable work cannot begin until a fully executed Grant Agreement is in place.
- All Grant Agreements must have an end date no later than March 31, 2027; time extensions will not be available.

- The grantee is responsible for ensuring that all applicable state and federal permits have been secured, cover the proposed activities, and remain in good standing for the grant term.

If you have questions, please contact the CDFW regional grant manager, Ricka Stoelting or email nccp@wildlife.ca.gov. Thank you for your interest in the LAG Program. We look forward to working with you.

Sincerely,

DocuSigned by:
Jeff Drongesen
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Jeff Drongesen, Branch Manager
Habitat Conservation Planning Branch

ec: Edmund Sullivan
Santa Clara Valley Habitat Agency

Joseph Terry
United States Fish and Wildlife Service

California Department of Fish and Wildlife

Joshua Grover, Deputy Director
Ecosystem Conservation Division

Chad Dibble, Deputy Director
Wildlife and Fisheries Division

Scott Gardner, Branch Chief
Wildlife Branch

Karen Weiss, Environmental Program Manager
Habitat Conservation Planning Branch