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JUL 24 2013
DIVISION OF WATER QUALITY

Attachment E – Notice of Intent

WATER QUALITY ORDER NO. 2013-0002-DWQ
GENERAL PERMIT NO. CAG990005

STATEWIDE GENERAL NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FOR RESIDUAL AQUATIC PESTICIDE DISCHARGES TO WATERS OF THE UNITED STATES FROM ALGAE AND AQUATIC WEED CONTROL APPLICATIONS

I. NOTICE OF INTENT STATUS (see Instructions)

Mark only one item	A. New Applicator	B. X Change of information: WDID# 249AP00048
	C. ☐ Change of ownership or responsibility: WDID#	

II. DISCHARGER INFORMATION

A. Name CALIFORNIA STATE PARKS, DIABLO VISTA DISTRICT			
B. Mailing Address 845 CASA GRANDE ROAD			
C. City PETALUMA	D. County SONOMA	E. State CA	F. Zip 94954
G. Contact Person CHRISTINA FREEMAN	H. E-mail address Christina.Freeman@parks.ca.gov	I. Title ENVIRONMENTAL SCIENTIST	J. Phone 707.769.5652 x 209

III. BILLING ADDRESS (Enter Information *only* if different from Section II above)

A. Name			
B. Mailing Address			
C. City	D. County	E. State	F. Zip
G. E-mail address	H. Title	I. Phone	

IV. RECEIVING WATER INFORMATION

A. Algaecide and aquatic herbicides are used to treat (check all that apply):

1. ☐ Canals, ditches, or other constructed conveyance facilities owned and controlled by Discharger.
   Name of the conveyance system: _____
2. ☐ Canals, ditches, or other constructed conveyance facilities owned and controlled by an entity other than the Discharger.
   Owner's name: _____
   Name of the conveyance system: _____
3. Directly to river, lake, creek, stream, bay, ocean, etc.
   Name of water body: SOUTHAMPTON BAY, TO SAN PABLO BAY

B. Regional Water Quality Control Board(s) where treatment areas are located
(REGION 1, 2, 3, 4, 5, 6, 7, 8, or 9): Region 2__(SAN FRANCISCO BAY)
(List all regions where algaecide and aquatic herbicide application is proposed.)

V. ALGAECIDE AND AQUATIC HERBICIDE APPLICATION INFORMATION

A. Target Organisms: AQUATIC WEEDS (SURFACE) THREATENING ENDANGERED SPECIES HABITAT IN SOUTHAMPTON BAY NATURAL PRESERVE, INCLUDING, BUT POTENTIALLY NOT LIMITED TO, PERENNIAL PEPPERWEED.

B. Algaecide and Aquatic Herbicide Used: List Name and Active ingredients
GLYPHOSATE (PRODUCT BRAND NAME ROUNDUP CUSTOM®)

C. Period of Application: Start Date ANNUAL APPLICATIONS USUALLY BEGIN IN FEBRUARY _____ End Date ANNUAL APPLICATIONS USUALLY END IN JULY

D. Types of Adjuvants Used: MODIFIED VEGETABLE OIL (BRAND NAME COMPETITOR®)

VI. AQUATIC PESTICIDE APPLICATION PLAN

Has an Aquatic Pesticide Application Plan been prepared and is the applicator familiar with its contents?
☐x Yes ☐No

If not, when will it be prepared? _____

VII. NOTIFICATION

Have potentially affected public and governmental agencies been notified? ☐X Yes ☐No

VIII. FEE

Have you included payment of the filing fee (for first-time enrollees only) with this submittal?
☐YES ☐NO ☐x NA

IX. CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment. Additionally, I certify that the provisions of the General Permit, including developing and implementing a monitoring program, will be complied with."

A. Printed Name: Christina Freeman

B. Signature: [signature] **Date:** 7/24/13

C. Title: Environmental Scientist

XI. FOR STATE WATER BOARD STAFF USE ONLY

WDID:	**Date NOI Received:**	**Date NOI Processed:**
Case Handler's Initial:	**Fee Amount Received:** $	**Check #:**
☐ **Lyris List Notification of Posting of APAP**	**Date** _____	**Confirmation Sent** _____

PROJECT DESCRIPTION

Benicia State Recreation Area (BSRA) is located in the southwest portion of Solano County, on the north shore of the Carquinez Strait at Southampton Bay, between the cities of Benicia and Vallejo near Interstate 780 (Figure 1).

The park is approximately 469 acres in size. It includes portions of Southampton Bay and Dillon Point. Its southern boundary includes the shoreline of Dillon Point and stretches across the water and mudflats of Southampton Bay. The state began acquiring tide land and tax delinquent property on the Dillon peninsula in 1955, calling it Benicia Beach State Park. The Benicia State Recreation Area opened in 1967, and included within it the Southampton Bay Natural Preserve (Preserve), which protects the sensitive marsh and the rare and endangered plant and animal species that inhabit the area. Trails in the park include the 1.2 mile Marsh Trail and a .75 mile bike trail along 780 that loops into the uplands of the marsh. In 2004, the Forrest Deaner Native Plant Botanic Garden was opened in the picnic area, a unique project as a joint effort of the California Native Plant Society (CNPS) and the California Department of Parks and Recreation (DPR).

BSRA is located in an area where strong winds and water currents are funneled through Carquinez Strait, where saltwater from the San Francisco Bay meets freshwater from the Sacramento and San Joaquin rivers. The wetland area is the outlet of a fairly small drainage basin (about 4 square miles), drained by nine unnamed drainages. The drainage into the wetland creates a complex network of channels. The park is situated within the Central Coast Floristic region of the California Floristic province and contains Valley and foothill grasslands (non-native grasslands, cismontane native grassland, Valley needle grassland, and Valley wildrye grassland), wetlands (Northern coastal salt marsh, coastal brackish marsh, coastal and Valley freshwater marsh), and Central coastal scrub communities.

In the wetlands of the Preserve, runoff from the local watershed mixes with tide water to support a gradient of freshwater to brackish and progressively more saline estuarine emergent wetlands. The Preserve is dominated by halophytic vegetation typical of San Francisco Estuary salt marshes. Also, please note that several special status species occur within BSRA which are listed as federal or state threatened or endangered.

It is a high priority for DPR to address impacts of infestations of invasive weeds on sensitive tidal marsh habitat and associated endangered species in the Preserve. The invasive weed control program in this unit is expected to enhance and increase potential habitat for native and endangered plant and animal species known to occur in the marsh. With the exception of invasive cordgrass control (*Spartina* ssp), which is permitted and managed under the Invasive Spartina Project WDID, currently, DPR is only implementing control activities for perennial pepperweed (*Lepidium latifolium*) (LELA) in the marsh, but hopes to add secondary invaders into the control program in the future, such as wild celery (*Apium graveolens*) or black rush (*Juncus gerardi*) as funding is secured and approval is obtained from regulatory agencies. All current LELA control activities in the marsh have been reviewed and approved by the California Department of Fish and Wildlife (CADFW) and the U.S. Fish and Wildlife Service (USFWS).

LELA is a weedy mustard plant native to Eurasia that is aggressively invading wetlands, croplands, and riparian corridors in western North America. The U.S. Bureau of Land Management classifies LELA as a noxious weed (Chen et al., 2005) and the California Department of Food and Agriculture

lists it among the Class B noxious weeds due to its highly invasive and ubiquitous nature. The aggressive perennial herb can form monospecific stands and change soil salinity profiles (Blank and Young 1997, Hogle et al., 2007). In California estuarine salt marshes, LELA is actively displacing several endangered plant populations and it reduces biomass and stature of perennial pickleweed habitat that supports other native wetland dependent species (Grewell *et al.*, 2007). Effective eradication or managed control of LELA is an essential action relative to the recovery of endangered species in the Preserve. 2011 surveys for LELA within BSRA indicate that it currently inhabits approximately 36 acres (Figure 2); 2012 survey results are still being finalized.

Given that the majority of the LELA patches within BSRA occur along depositional/disturbance corridors (e.g. slough banks, trailsides, and roadsides), DPR looks to treat all known acreage of LELA within the marsh area of the park. Spray crews will consult a tide chart to coordinate spraying times with ebbing tide events.

Following control activities, management of new infestations will be an ongoing stewardship activity. Given that dislodged roots can move along riparian corridors to start new infestations downstream, a main potential source of new propagules is transport via flotation and animal vectors from off site aquatic sources, including both tidal influx areas and the unnamed freshwater channels, which mostly carry runoff from surrounding subdivisions. Other potential sources for new propagules include human dispersal along roads and trails within the park and windborne dispersal from adjacent properties. Active monitoring will be implemented to detect newly colonizing pioneers. If new satellite patches are detected within the park, they will be treated as quickly as possible.

Within the Preserve, the LELA occurs in sensitive plant and wildlife habitat. Due to endangered species concerns these patches will not be treated unless treatment is permitted under the Endangered Species Act. Likewise, treatment methods and staff are trained to minimize their marsh impact as well as to identify signs of endangered species. For further information regarding endangered species impact avoidance and management during LELA control activities, see *Benicia State Recreation Area, Southampton Bay Natural Preserve, Lepidium latifolium Control Project for Endangered Species and Tidal Marsh Recovery (DPR, 2009).* All activities in the marsh have been reviewed and approved by the CADFW and the USFWS.

PERENNIAL PEPPERWEED TREATMENT APPROACH

Many site factors were evaluated when determining the appropriate treatment approach for LELA at BSRA, including the presence and proximity of special status species, recent research regarding LELAtreatment options in comparable habitats within the San Francisco Bay area and associated efficacy rates, accessibility, revegetation goals, and required duration of commitment associated with each treatment method. Recent studies in tidal/brackish systems have found that, with the exception of continual flooding, no non-chemical treatments have been found to effectively control this weed as a sole control option (Renz and DiTomaso, 1998). Given that LELA mainly propagates clonally from its brittle rhizome-like roots, manual control options are typically not effective. Roots fragmented by mechanical and hand removal actions will actually increase infestation densities and facilitate spread. In addition, deep-seated rootstocks make LELA extra persistent in the soil strata, even if manual removal is attempted and partial root fragments remain. As stated above, DPR will treat all known acreage of LELA in the marsh (See Figure 2).

Herbicide Determination

One of the aquatic-labelled herbicide approved for use in the Diablo Vista District by our annual Pesticide Control Advisor (PCA) recommendations is glyphosate (product brand name Roundup Custom®) is an aqueous solutions containing 53.8% glyphosate in its isopropylamine salt form or 4 lbs. acid per gallon, and contain no inert ingredients other than water. The primary decomposition product of glyphosate is aminomethylphosphonic acid, and the commercial product contains an impurity, 2,4-nitrosoglyphosate.

When reviewing the impacts glyphosate has on plants, although it is non-selective and can damage any vegetation that it contacts during application, it has been shown to have lower non-target species impacts than other aquatic approved herbicides because it binds to soil upon contact and is therefore rendered immobile. Once it binds to the soil particles, it is not available for plant uptake and will not affect plants whose roots grow into the treatment zone. In addition, the strong affinity for this product to soil particles prevents the herbicide from leaching out of the soil profile and into groundwater.

When implementing chemical control in any park, of greatest concern to DPR is the proximity of the treatment area to special status species habitat and the affects of the treatment on non-target species. At BSRA, the limiting factor when determining treatment approach is the proximity of special status species and sensitive habitats to the weed patches. It is imperative that this control program avoids chemical impacts to adjacent habitats, particularly those utilized by the listed species in the area (See the 2009 Project Proposal for more details regarding endangered species impact avoidance.)

Note that all herbicide use in the Diablo Vista District is dictated by our annual PCA recommendations. The 2013 recommendations include glyphosate for use in aquatic areas for broad leafed weeds.

Given DPR's resource goals, the 2013 PCA recommendations, and the characteristics listed above related to non –target plant and animal impacts, glyphosate is the most appropriate choice for this control project.

Surfactant Determination

As with herbicides, surfactant use and type are dictated by our annual Pesticide Control Advisor annual recommendations. The 2013 recommendation for surfactants for aquatic herbicide application to this type of target weed include Competitor® as an option. Made by Wilbur-Ellis Company, Competitor® is a modified vegetable oil containing a non-ionic emulsifier system. The ingredients include ethyl oleate, sorbitan alkyl polyethoxylate ester, and dialkyl polyoxy-ethylene glycol. Toxicity studies classified this surfactant as toxicity category of 3-4 (CAUTION).

Given DPR's resource goals, the non-toxic characteristics of Competitor® and the 2013 PCA recommendations, this surfactant is the most appropriate choice for this control project.

RECOMMENDED WEED CONTROL ACTION PLAN

The approach for weed treatment at BSRA will focus on the following elements:

- Multi-year Herbicide Applications. Taking all of these aspects into consideration, DPR proposes a multi-year, annual treatment of all LELA known to exist within the marsh at BSRA and proposes using the herbicide Roundup Custom® in combination with the nonionic surfactant Competitor® via foliar application direct spot spraying and hand wicking.

- Timing of Herbicide Application. Studies have shown that herbicide does not translocate to roots once LELA plants are in full bloom (Renz 2002,2004). Herbicide applications to LELA have typically been most effective when it is actively growing and has reached flower bud-to early-flower initiation life stages (usually occurring April to May). This promotes translocation to roots that increases efficacy by killing or reducing below ground reserves, and also allows for easy detection and identification of target plants.

- Pre-Spray Weed Detection. Given the exclusion zones which disallow entry after January into many of the marsh areas supporting LELA, mapped LELA Distribution data from the previous year will guide treatment activities.

- Herbicide application will be done by a licensed, qualified pesticide applicator. The chemical control will be implemented by competent licensed personnel on foot with backpack sprayers. The contractor will have notable field experience implementing chemical control programs for invasive plants in sensitive tidal marsh habitats and will be under contract to abide by all guidelines listed in the 2009 Project Proposal.

Glyphosate Application Guidelines

The project personnel will follow the 2013 DPR PCA Recommendations and the Roundup Custom product label guidelines for application. Specifically, for low volume hand-held equipment applications, DPR's 2013 PCA recommendations dictate a ¾ to 2 percent solution rate (depending on leaf area) for Roundup Custom applications, with 2 quarts of a non-ionic surfactant (Competitor®) per 100 gallons spray solution for directed spot treatments. The Roundup Custom label recommends a maximum of 8 quarts per acre per year. The applications will be timed to coincide with ebbing tides to protect non-target vegetation, to allow a minimum of 6 hours of drying time. Herbicide will be applied only to areas where LELA is known to exist.

Colorants or dyes may be used at the recommended label rate per the pesticide applicator's discretion. During treatment, the contractor will uniformly cover and penetrate the plant's foliage, adjusting volume of spray as necessary to ensure coverage. The contractor will apply on a spray-to-wet basis; avoiding runoff.

Best Management Practices

The project best Management Practices (BMP's) shall include, at the minimum:

Measures to prevent pesticide spill. All individuals applying herbicides will receive training on safety and application procedures prior to any spraying. On-site mixing and filling operations shall be confined to areas appropriately protected to minimize spread or dispersion of spilled herbicide or surfactant into surface waters. All portable spray equipment shall be properly maintained to prevent leakage of any solution during transport or usage.

Measures to ensure that only a minimum and consistent amount is used. The backpack sprayer tips are calibarated on cone and jet tip settings at 20lbs of pressure to meet the application rate and reduce misting. The applicator will only treat the target species in accordance with the herbicide label specifications and the written recommendation as indicated by the PCA. A meduim volume backpack sprayer with an adjustable cone/jet tip will be used for a foliar application to the leaves of the plant and at a height no greater the 6" above the plant top. The plants are sprayed to wet and avoiding run-off. A wicking method is used to treat the plant leaves within 1 meter of critical habitat.

Field staff training regarding potential adverse effects to waters of the U.S. due to pesticide application. All field crews are trained by DPR staff and their field supervisors prior to marsh entry regarding the sensitivity of the waters within the sloughs, tidal creeks, and bay in the project area; given the suite of sensitive species at this site, the application of the pesticide is very meticulous and detail oriented. Therefore, all environmental site condition guidelines are strictly followed (e.g. wind speed) and consistent supervision by the field manager occurs at all times. No mixing or pouring occurs near any on-site waterbodies.

Specific BMPs for each spray mode. Two hand spray methods are used to treat the invasive plant species. The first is a foliar application using a medium volume back pack sprayer to treat plant specific weeds and the second is the use of a commercial grade spray bottle and sponge for wiping the individual leaves.

Specific BMPs for each pesticide product used. All guidelines, recommendations and restrictions on the product labels will be followed.

Specific BMPs for each type of environmental setting. As stated above, given the suite of sensitive species in the wetland at the project site, the application of the pesticide is very meticulous and detail oriented. Therefore, all environmental site condition guidelines are strictly followed (e.g. wind speed) and consistent supervision by the field manager occurs at all times. Field crew size is kept to a minimum (usually around 6 individuals); access to the treatment areas varies seasonally to avoid impacts to special status avian, mammal and plant species within the marsh. During bird nesting\breeding and active plant growing seasons, treatment activities are either delayed or treatment methodology is dictated by Endangered Species Protection Zones, within which specific treatment approaches occur to avoid impacts to the community. Specifically, hand wicking occurs in protective zones within close proximity to the rare plants on-site. Some areas with potential avian nesting substrate are not to be entered until after the bird breeding season (September); others are to be completely avoided due to resident special status avian populations. Still other avian nesting areas may be approved by the U.S. Fish and Wildlife Service (USFWS) to be entered for treatment during the breeding season if entry accompanied by a permitted avian specialist; this is reviewed annually and management strategies subsequently adapted. All activities in the marsh were initially reviewed and approved by the CADFW and the USFWS when the project was first proposed and are now re-reviewed annually by these agency representatives.

REFERENCES

Blank, R.R. and J.A. Young. 1997. *Lepidium latifolium*: Influences on soil properties, rate of spread, and competitive stature. Plant Invasions: Studies from North America and Europe. Backhuys Publishers, Leiden, The Netherlands.

Chen, H., R.G. Qualls, and R.R. Blank. 2005. Effect of soil flooding on photosynthesis carbohydrate partitioning and nutrient uptake in the invasive exotic *Lepidium latifolium.* Aquatic Botany.

California Department of Parks and Recreation. 2009. Benicia State Recreation Area, Southampton Bay Natural Preserve *Lepidium latifolium* control project for endangered species and tidal marsh recovery. March 2009.

Grewell, B.J., J.C. Callaway, and W.R. Ferren, Jr.. 2007. Estuarine Wetlands. pp. 124 – 154 *in*: M.G Barbour, T. Keeler-Wolf, and A.A. Schoenherr (eds.). Terrestrial Vegetation of California, 3rd. Edition. University of California Press, Berkeley, California.

Hogle, I., R. Spenst, S. Leininger, and G. Block. 2007. San Pablo Bay National Wildlife Refuge Lepidium latifolium Control Plan. U. S. Fish and Wildlife Service, San Pablo Bay National Wildlife Refuge, Petaluma, California.

Monsanto. 2013. Roundup Custom® Herbicide Label. Monsanto Company. 800 North Lindberg Boulevard, St. Louis Missouri, 63167.

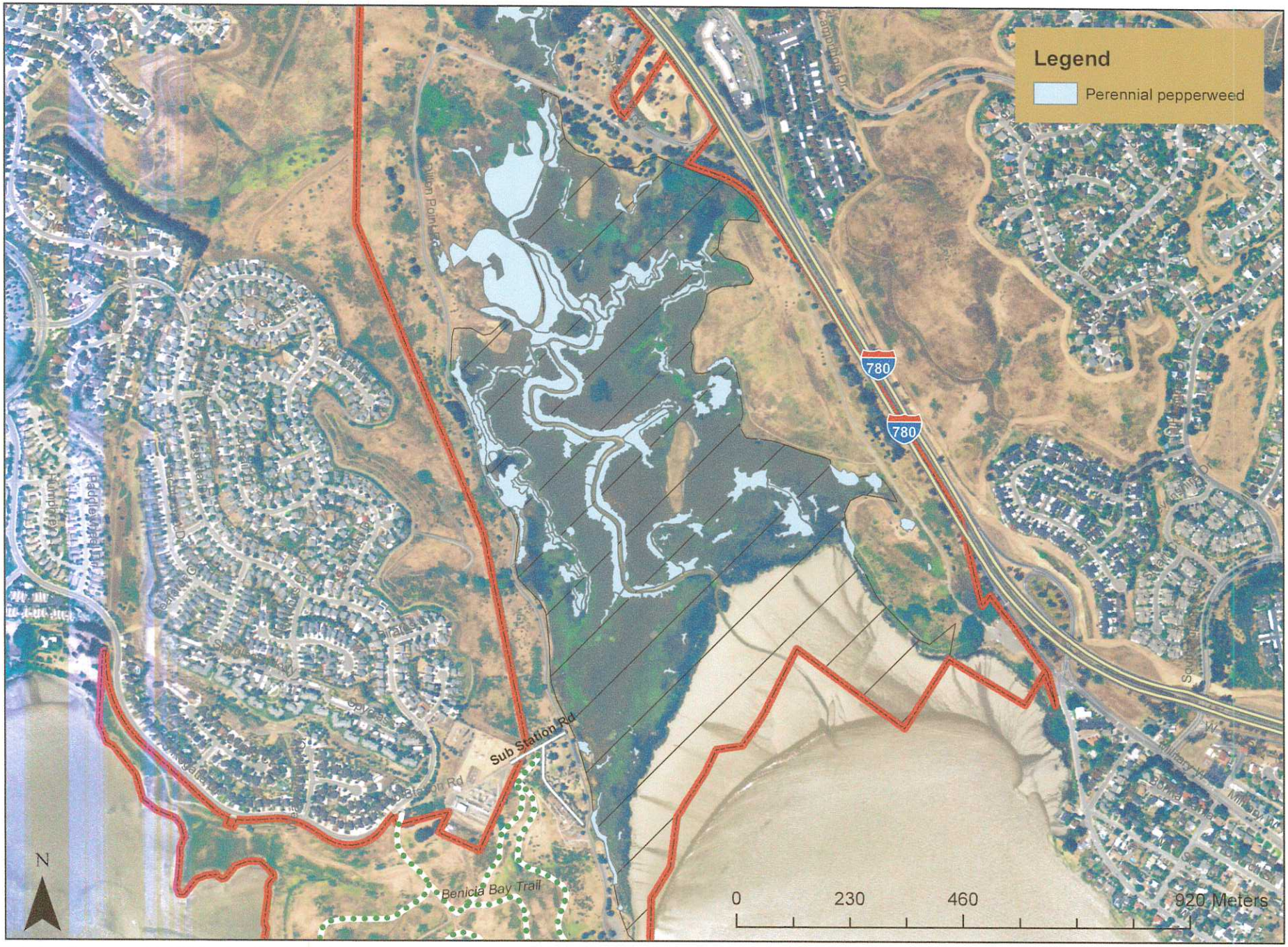
Renz, M. J. and J. M. DiTomaso. 1998. The effectiveness of mowing and herbicides to control perennial pepperweed in rangeland and roadside habitats. California Weed Science Society Meetings.

Renz, M. 2002. Biology, ecology and control of perennial pepperweed (*Lepidium latifolium* L.). Plant Biology. University of California, Davis

Renz, M. J. and R.R. Blank. 2004. Influence of perennial pepperweed (*Lepidium latifolium*) biology and plant-soil relationships on management and restoration. Weed Technology.

Figure 1 Project Location, Benicia State Recreation Area, WDID# 2 49AP00048, APAP 2013

Figure 2 Approximate Pepperweed Locations within the Project Area, Benicia State Recreation Area, WDID# 2 49AP00048, APAP 2013



Data Source: USDA, Agricultural Research Service, 2012

Educating Applicators on Adverse Effects

To educate applicators on avoiding adverse effect from pesticide application, spray personnel working in the tidal wetlands at Benicia State Recreation Area (BSRA) are first trained on the definition and potential impacts of spray drift as defined by the Department of Pesticide Regulation. Training also includes methods for determining when pesticide drift becomes unacceptable, due to imprecise application methods or applications occurring under environmental conditions that prohibit the applicator from maintaining control over the path the pesticide takes once it leaves the application equipment. Department of Parks and Recreation (DPR) requires contractors ensure that all herbicide application be managed to minimize spray drift to protect human health and the environment, including adaptively adjusting methodology according to site conditions (e.g. proximity to channels), environmental conditions (e.g. wind speed), and all other guidelines listed on the product labels to minimize spray drift. Specific site condition directives implemented during project activities at BSRA require the applicators are directed to treat any target weeds located adjacent to the channels parallel to or from outside the marsh plain channel edge with the spray tip angled horizontal to the soil surface and the spray is away from water. With this approach, the total amount of an herbicide's active ingredient exposed to the channel stream is probably less than 2 gallons of solution.

All field crews are trained by DPR staff and their field supervisors prior to marsh entry regarding the sensitivity of the waters within the sloughs, tidal creeks, and bay in the project area; given the suite of sensitive species at this site, the application of the pesticide is very meticulous and detail oriented. Therefore, all environmental site condition guidelines are strictly followed (e.g. wind speed) and consistent supervision by the field manager occurs at all times. See the Least Intrusive Method of Herbicide Application section for more details.

Examination of Possible Alternatives

DPR researched the range of management approaches used to control perennial pepperweed. Management of this weed the wetlands at this particular site presents a number of challenges, including difficult access, limited management options, and limited herbicide choices (Hutchinson and Viers 2011). Further complications arise in planning strategies because a strategy used to control this weed can result in quite different outcomes at multiple sites due to variation in environmental conditions (e.g. Wilson et al. 2008, Whitcraft and Grewell 2012). For these reasons, DPR recognized it was essential to proceed with careful evaluation of site environmental conditions and potential methods, consult with weed management and sensitive species experts, and to use controlled experiments to assess the efficacy of management actions. DPR also recognized that selection of an experienced contractor with expertise in weed management within sensitive aquatic habitats would be essential. In addition, any herbicides and surfactant use and type within State Parks are dictated by the District's annual Pesticide Control Advisor annual recommendations. Potential methods were reviewed by ecologists with in depth knowledge of the Preserve, and discussed with experts on resident endangered species, FWS and DFW biologists, and permitting agencies.

An evaluation of the management options may be found below.

No Action

The target weed occurs within wetlands which hold a great regional biological importance and support a richly diverse suite of native plant and animal species, so much that the site was designated by State

Parks as a Preserve and named the 'Southampton Bay Wetland Natural Preserve'. The tidal marsh at BSRA supports numerous State and federal listed plant and animal species, including species listed by both the State and federal agencies as endangered, such as Soft bird's beak(*Chloropyron molle* subsp. *molle)* and salt marsh harvest mouse *(Reithrodontomys raviventri).* BSRA has been designated an Important Bird Area (IBA) by BirdLife International being globally important habitat for the conservation of bird populations including California black rail, (*Laterallus jamaicensis coturniculus),* a State threatened species, and in some years the State and federally Endangered California clapper rail *(Rallus longirostris obsoletus).* Northern harrier *(Circus cyanus*), short eared owl (*Asio flammeus*), "saltmarsh" common yellowthroat *(Geothylypis trichas sinuosa*), and "Suisun" song sparrow (*Melospiza melodia maxillaris*) are also resident bird species of conservation concern (Evens 2011); in addition, migratory waterfowl utilize the habitat in winter. Rare plants include Jepson's "Delta" tule pea (*Lathyrus jepsonii* var. *jepsonii*) and Humboldt Bay owl's clover *Castilleja ambigua* var. *humboldtiensis*), and both taxa are ranked 1B.2 in California Native Plant Society's (CNPS) list of rare threatened and endangered plants in California (CNPS 2013). Recent studies have found that *Chloropyron molle* subsp. *molle and* the diversity and abundance of native plant and animal communities of the tidal wetland ecosystem at Southampton Bay Wetland Natural Preserve have recently been directly threatened by the colonization and aggressive spread of invasive perennial pepperweed (Grewell et al, 2013). The weed displaces native species, reducing habitat quality and thereby minimizing biodiversity. Therefore, negative action would lead to the reduction of native habitat in the tidal wetland at BSRA. Given these scientific facts, and the State Park's Mission directive to 'preserve the state's extraordinary biological diversity by protecting its most valued natural resources', a No Action alternative resulting in loss of biodiversity and impacts to endangered plant and animal species is not within the Departments Mission directives.

Based on the discussion above, a No Action alternative is not an option for this project.

<u>Prevention</u>

This species reproduces by both propagule and seed. Seeds are capable of being transported by wind, water and possibly waterfowl (INVSDIV PLANT BOOK).The life cycle of this weed includes both sexual and asexual reproductive pathways (Grewell et al, 2013). Genetic diversity of populations in the United States is quite low, suggesting increases in stand size are primarily due to spread by rhizomes or seed derived from outcrossing of genetically identical plants or self-fertilization (Gaskin et al. 2012). Therefore, these stands can continue to increase on their own, making prevention of expansion impossible.

There are currently approximately at least 36 acres infested by the weed at the site. During the past 20 years, perennial pepperweed has dramatically increased its range within California where it has invaded nearly every county (Grewell, B.J., C.J. Futrell and M.J. Skaer. 2013). Given the widespread distribution of this weed, State Parks is not able to control seed sources present off of our property or the delivery of seed by wind, water and animals. In addition, given the ability of large stands to self-fertilize and the large amount of underground root mass at the site, preventing growth within the marsh at BSRA is unlikely.

Based on the discussion above, a Prevention alternative is not an option for this project.

<u>Mechanical or Physical Methods</u>

Given the State and federal threatened and endangered species and aquatic resource sensitivity at the site, mowing, disking, cutting, grazing, or controlled burning or flooding could not be considered for use within the tidal wetland at this site. In addition, recent studies in tidal/brackish systems have found that, with the exception of continual flooding, no non-chemical treatments have been found to effectively control of perennial pepperweed as a sole control option (Renz and DiTomaso, 1998). Perennial pepperweed mainly propagates clonally from its brittle rhizome-like roots, therefore, mechanical methods are typically

not effective (Young, et al, 1998). Segments shorter than one inch are capable of resprouting; roots fragmented by mechanical and hand removal actions will actually increase infestation densities and facilitate spread, as proven by ineffective disking and mowing experiments. Although it has been shown that prolonged inundation reduces perennial pepperweed survival, as stated above, this option is not feasible given the nature of the tidal marsh BSRA and the State Parks Mission directive to protect valued natural resources, such as the threatened and endangered plant and animal species and their habitat within the marsh at BSRA, whose survivability under inundation is unlikely to impossible.

Based on the above stated discussion, mechanical or physical methods are not an option for this project.

Biological control agents

Based on recent science, there are no *L. latifolium*-specific biocontrol agents, either insects or plant pathogens such as fungi, available for use (Grewell, B.J., C.J. Futrell and M.J. Skaer. 2013).

Therefore, biological control agents are not an option for this project.

Algaecides and aquatic herbicides;

DPR utilized on-site experience, reviewed regional results, and consulted with experts to select a site-appropriate herbicide. A number of herbicides have been utilized for management of perennial pepperweed, and chlorsulfuron and imazapyr are widely considered to be effective for control of this species. Chlorsulfuron (Telar®) is a broad-spectrum herbicide that is being used for control of this weed in terrestrial habitats, and in some seasonal wetlands, but application is prohibited in intertidal areas below mean high water, in areas where surface water is present, and in irrigation ditches or canals including their outer banks because of the persistence and mobility of the chemical in water and soil. The efficacy of chlorsulfuron is also low when applied without prior mowing in an integrated management scheme (Renz and DiTomaso 2004), and mowing is not possible due to potential harm to salt marsh harvest mouse and California black rail, and use of this herbicide in tidal wetlands is not permitted (Grewell, B.J., C.J. Futrell and M.J. Skaer. 2013).

Aquatic formulations of imazapyr and glyphosate are the only herbicides registered by US EPA for use in estuarine wetlands in California (Kerr 2012). Imazapyr has been an effective tool for management of perennial pepperweed at San Pablo Bay National Wildlife Refuge in the North Bay reach of San Francisco Estuary (Block et al. 2012). However, the environmental conditions (e.g. sediment characteristics, hydrologic regimes and plant community composition and diversity) of invaded tidal wetlands in the Suisun sub-region of the Estuary are quite different from North, Central and South Bay tidal wetlands (Grewell, B.J., C.J. Futrell and M.J. Skaer. 2013). Response of both undesired and desirable vegetation to management actions depends on environmental conditions specific to the project site. In a seasonal tidal wetland transition area at Rush Ranch in Suisun Marsh, imazapyr reduced perennial pepperweed by 90%, but non-target impacts to native vegetation were severe and persistent (Whitcraft and Grewell 2012). Imazapyr (Habitat®) has previously been applied for control of *Spartina patens* in the Preserve at BSRA, and though this chemical is considered to have low toxicity, it was rejected for this project due to its persistence and undesirable impacts to native vegetation.

DPR chose foliar applications of the non-selective herbicide glyphosate (aquatic formulation, Aquamaster ®) for this project since glyphosate has very low acute toxicity, is highly soluble in water, binds to soil, and is quickly inactivated in water and soil by microbial degradation (Schuette 1998; Geisy et al. 2000). Glyphosate had proven to be effective for perennial pepperweed management at other sites in the Suisun region, though like all other herbicides, for best results follow-up applications were required for several years (Trumbo 1994). Applications of glyphosate herbicide at flower bud stage is widely recommended as

an effective control regime for perennial pepperweed, and effectiveness is best where infestations are not dense (Boelk 2009). For dense infestations, efficacy can be improved when weed patches are mowed or grazed followed by foliar applications of glyphosate at flower bud stage. In seasonal wetlands (including Grizzly Island), and in floodplain and riparian wetlands (Consumnes River Preserve, Sacramento-San Joaquin Delta) mowing followed by regrowth and applications of glyphosate at bud stage were highly effective for perennial peppeweed control (Renz and DiTomaso 2004, 2006, Hutchinson and Viers 2011). However, mowing or cutting and grazing are not advised or permitted in tidal wetlands due to potential take of endangered species. Where appropriate, an integrated scheme using glyphosate, tillage and tarping can also be highly effective (Hutchinson and Viers 2011).

Least Intrusive Method of Herbicide Application

In order to best utilize this product in the least intrusive manner in a tidal wetland, applications must very carefully implemented in the field by knowledgeable experienced personnel and application timing must precisely coincide with weed phenology so as to reduce the likelihood for non-target impacts and/or the necessity for secondary treatments during the growing season. This weed bolts rapidly, and it is important to apply herbicide before the life stage transition of the plant from bud to flowering stages. Leaf area of perennial pepperweed tends to be highest at flower bud stage, and this is the ideal time to apply herbicides (Grewell, B.J., C.J. Futrell and M.J. Skaer. 2013). At this critical life stage, the plants present the most leaf surface area for translocation of applied chemical throughout the plant, including to below ground rhizomes and roots for effective control. Studies using radio-labeled herbicide (14C-glyphosate) indicate that herbicide applied to *L. latifolium* during flower or fruit stage remains in the canopy and does not translocate, but when the weed is treated when flower buds appear prior to bloom, herbicide translocates down through the plant and into the perennial roots and efficacy of management is thereby increased (Renz and DiTomaso 2004). Post-bloom treatments are not feasible because leaves of the plant (required for herbicide uptake) die quickly after bloom.

To reach these goals, firstly, DPR contracted this work through the State process and incorporated very specific contract specification regarding experience with aquatic habitats and sensitive species habitat. This includes requiring a Qualified Applicator on-staff to oversee and manage the spray labor crew, a working knowledge of the Walking in the Marsh protocol, as well as intimate knowledge of all pesticide and water quality best management practices, housekeeping skills, and spill prevention approaches. For this project, staff must utilize foliar application methods as well as hand-wicking, depending on proximity to sensitive species. Non-target impacts to endangered plants from both trampling and herbicide are not acceptable within the constraints of this project, so the contractor must be acutely aware of his/her surroundings at all times, including identification of the plants and animals in the natural environment within the project area and the potential effects of the herbicide on the environment around the target weed. Secondly, DPR partnered with the USDA Agricultural Research Service Weeds Unit and other species experts to co-manage the tidal marsh recovery efforts in the marsh at BSRA. One of the project elements contributed by the USDA team included evaluation of perennial pepperweed phenology to inform management of appropriate treatment timing. In 2010 and 2011, USDA performed an evaluation of phenology every two weeks through February, and then weekly in March and April prior to herbicide applications. The team recorded the predominant phenological stage of the plants within the monitoring plots, and three plants per plot were collected and measured for shoot height and subsequently evaluated for whole plant leaf area (2010 only). The complete suite of measurements was performed immediately prior to herbicide application in 2011. Leaves on collected plants were removed and photographed against a white background that included a metric ruler for scale. In 2010, these images were imported for analysis into SigmaScan Pro® 5.0 Image Analysis Software (Systat Software Inc., San Jose, CA). In 2011, USDA analyzed leaf area using WinFOLIA® software (Regent Instruments, Inc., Quebec, Canada). In April 2012, USDA performed a marsh-wide descriptive assessment of phenology accompanied by photographic

documentation. The results of these assessments were the basis for DPR decision regarding the timing of herbicide initiation each year.

Given that application is contracted only to strictly trained, certified and experienced labor personnel with experience in sensitive aquatic environments, the sensitivity used on-site by spray personnel related to application delivery and non-target impacts, and the in-depth analysis performed by project partners to determine the appropriate phonological stage for this target weed under these site specific environmental conditions, this is the least intrusive use of aquatic herbicide for this target weed and location.

Decision Matrix for Project Management

As with all conservation management strategies, a weed management project must start with a clearly defined problem and specific goal. The next steps in the process are to gather crucial information and evaluate baseline data necessary for development of a site-specific management strategy, select strategies that are most appropriate for microsite conditions, prepare environmental documentation, consult with regulatory experts and secure permits, adjust strategies based on feedback, and develop a monitoring program and experiments for adaptive management decision-making. The steps followed to formulate this project plan were as follows (Grewell, B.J., C.J. Futrell and M.J. Skaer. 2013):

<u>1: INITIAL PROJECT PLANNING</u>

- Recognize weed invasion as a problem, identify target weed(s)
- Define purpose of weed management project
- Consider impact and invasiveness of target weed
- (e.g. distribution of sensitive/endangered species relative to
- distribution of the weed; potential rate and pathways of spread)
- Define specific, quantifiable goals for habitat (desired post- management outcome)
- Consider feasibility of eradication (magnitude of problem, access, restrictions, cost)
- Consider consequences of taking no action or of delaying action

<u>2: DEVELOP MANAGEMENT STRATEGY</u>

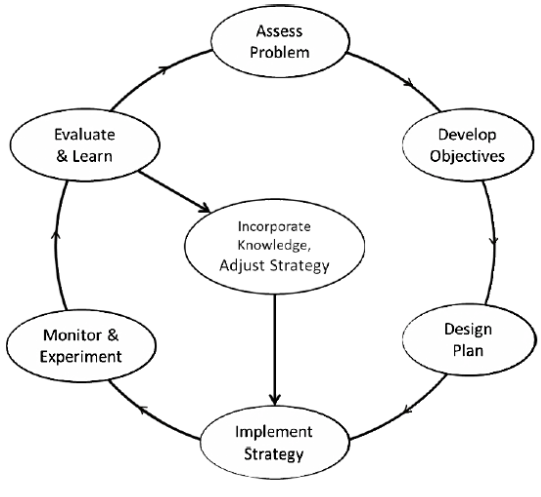
- Consider life history cycle, life stage vulnerability, habitat requirements of the weed
- Identify spatial distribution of target weed(s), pathways for dispersal
- Identify measures that may prevent new infestations
- Evaluate site-specific environmental data that may narrow management options (e.g. spatial variation of soil types, hydrologic regime; avoidance areas/times, sensitive species distributions)
- Stratify site by habitat conditions that affect management options
- Review management options that may fit site conditions/constraints
- Identify spatially stratified, site specific management strategies
- Review practices, regulatory requirements; consult with experts; acquire permits
- If strategy includes herbicides: select application rate and know maximum volume allowed per acre; choose appropriate adjuvant(s), application method/timing, and nozzle type/spray pattern that fit site environmental conditions and sensitivity
- Develop a monitoring strategy and experiments to evaluate efficacy of

management actions, non-target effects, short-term and long-term plant community response to inform adaptive management decision-making.

3: MANAGE

- Commit to a long-term, annual management effort to control perennial weeds with seed banks, storage reserves for resprouting
- Prepare for rapid response to newly established weed patches
- Select experienced project personnel (project managers and management team) with expertise in weed management, tidal wetland ecology, the local native flora and sensitive species
- Partner with scientists for adaptive management approach
- Train all field personnel in avoidance measures to protect sensitive species and resources
- Suppress/eradicate satellite populations to curb expansion and reduce propagule pressure
- Suppress/eradicate main population areas of infestation without endangered species or other access restrictions, corral sensitive zones that require alternative management
- Test and refine options to avoid non-target effects, use specialized techniques to contain/suppress weed sub-populations that overlap with endangered species.
- Modify, adjust or change management methods based on monitoring and experimental data to improve outcome and achieve overall project goals
- Long-term monitoring of plant community succession following weed eradication. Evaluate need for active revegetation or restoration of native plant community.

Given the suite of sensitive resources present at the site, the integration of an adaptive management strategy was crucial for project planning. The adaptive management model followed is depicted below (Grewell, B.J., C.J. Futrell and M.J. Skaer. 2013):



Based on the analysis described above, it was determined that the approach for weed treatment at BSRA would focus on the following elements:

- Multi-year Herbicide Applications. Taking all of these aspects into consideration, DPR proposes a multi-year, annual treatment of all the weed known to exist within the marsh at BSRA and proposes using the herbicide Roundup Custom® in combination with the nonionic surfactant Competitor® via foliar application direct spot spraying and hand wicking, determined based on proximity to sensitive species.
- Timing of Herbicide Application. To occur when perennial pepperweed plants are in full bloom (usually occurring April to May).
- Pre-Spray Weed Detection.
- Herbicide application done by a licensed, qualified pesticide applicator.

Sampling and Monitoring Plan

According to the Statewide General Permit and current NPDES requirements, site utilizing glyphosate must be sampled once per year for physical and chemical characteristics to determine if the residual aquatic herbicide discharge causes an exceedance of receiving water limitations. Water samples and physical characteristics will be gathered and recorded on site by a qualified contractor, who will take on the role of the Water Sampling Coordinator. The Water Sampling Coordinator will be responsible for assuring that all quality control requirements, such as chain of custody, decontamination, storage, and transport guidelines, are adhered to at all times. Water samples will be collected by hand using a sampling rod and a pre-cleaned amber glass 1-liter bottle provided by the contracted analytical laboratory and cleaned to EPA specification guidelines. The samples will be taken using a Yellow Springs Instrument Model 85, from one application event from each environmental setting (flowing water and non-flowing water) per year. To collect the sample, the bottle will be attached to the sampling rod with a clamp, extended out over the water at the application site, and lowered to approximately 50% of the water depth. When the bottle is filled, it will be pulled back out of the water and capped. The sample will be wiped clean with a paper towel and labeled in permanent ink with the sample location description, date, time, and initials of the sampler. The sample location description will be the initials of the park unit (BSRA). The sample information will be recorded into a field data form. In addition, the physical characteristics will be recorded into the form, including depth, water temperature, pH, dissolved oxygen, conductivity, and salinity measurements. Any observed site anomalies will also be noted.

Following collection, water samples will be stored in individual plastic bags to prevent cross contamination and placed on ice packs in a cooler and sent via Priority overnight deliver to a California Certified Lab with glyphosate testing capabilities. The contracted analytical laboratory service will likely be provided by either ALS Environmental or Agriculture & Priority Pollutants Laboratories, Inc. The samples will be quantified according to the EPA method number 547 within the appropriate holding times for glyphosate. If samples are not taken to the lab until the following day, they will be stored in a cooler on ice until they can be transferred to a refrigerator, and subsequently transferred back into a cooler for transport. The contracted analytical laboratory will provide a Quality Assurance Plan (QAP) that meets EPA standards prior to initiating analysis.

Field data forms and laboratory results will be stored at the Diablo Vista District office and available for inclusion in the annual reports.

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