Appendix J. Invasive Species Control Report, 2016

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Sears Point Tidal Marsh Levee Weed Management

2016 Summary Report

Prepared for:

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Shelterbelt Builders INC
An Open Land Management & Restoration Company

APPENDIX J

INTRODUCTION

The newly constructed levee system for the Sears Point tidal wetlands project is highly susceptible to invasion from invasive plants. Though a combination of natural native plant recruitment and supplemental planting is planned, much of the levee system remains relatively bare and unvegetated. Shelterbelt Builders was hired by the Sonoma Land Trust in the fall of 2016 to control priority invasive plants to help facilitate the process of natural revegetation.

Controlling invasive plant species has the following priority goals:

- **Enhancing the establishment of perennial native plant species**. The natural and assisted revegetation of the Sears Point tidal wetlands levee system will provide valuable transitional upland habitat for native species and further limit the establishment of invasive species.
- **Minimize the spread of invasive species to neighboring conservation and agricultural areas**. The Sears Pont tidal wetlands levee system connects to the San Pablo Bay National Wildlife Refuge, the Sears Point Wetland and Watershed Restoration Project area and adjacent Sonoma Land Trust lands that are managed for crop and range production. The levees, tidal flow, and a regional rail right-of-way all serve as connection and distribution pathways for invasive plant species to high value conservation and agricultural production areas, including other nearby areas undergoing restoration.
- **Provide safe access and positive experiences for the public**. Many of the most prevalent invasive plants of the Sears Point tidal wetlands have prickles, sticky glands, or thorns. In some years these plants overtop the main access trails and service roads, inhibiting public access and impeding views of restored and preserved native habitats.

The Sears Point tidal wetlands restoration project includes a modern levee design with gentle gradients to support a much wider band of transitional vegetation than older levee designs. These high marsh transitional habitats are found on the outboard sections of levees. As revegetation of these levees occurs, the lower elevations will be dominated by high marsh species such as marsh gumplant (*Grindelia stricta* var. *angustifolia*), salt grass (*Distichlis spicata*), and pickleweed (*Salicornia pacifica*) that transition to upper elevation species such as creeping wildrye (*Elymus triticoides*), common aster (*Symphyotrichum chilense*), bee-plant (*Scrophularia californica*), and coyote brush (*Baccharis pilularis*). As these transition zones mature, their dense canopies will leave little room for the colonization of non-native species.

WEED MANAGEMENT

The Sonoma Land Trust (SLT) and United States Fish & Wildlife Service (USFWS) have been increasing invasive species management actions within the San Pablo Bay National Wildlife Refuge and Sonoma Land Trust properties for many years. The addition of management within the Sears Point tidal wetlands project area will complement the efforts toward invasive species management in the greater region.

The transitional high marsh areas are most susceptible to invasion by non-native species during the early native plant establishment period. Shelterbelt's weed management work focuses on the highest priority invasive species during this establishment period, namely perennial pepperweed (*Lepidium latifolium*), stinkwort (*Dittrichia graveolens*), yellow starthistle (*Centaurea solstitialis*), and Pacific bentgrass (*Agrostis avenacea*). Two additional invasive plants, iceplant (*Carpobrotus* sp.) and New Zealand spinach (*Tetragonia tetragonioides*), are incidentally controlled when found in work areas.

2016 control efforts consisted of broadcast spraying all populations of the target weeds found on the levees, as shown in the attached map. All treatments in 2016 utilized the herbicides imazapyr and/or glyphosate (see table following report). Individual plants were not mapped at this stage as populations are extensive and the annual

species will fluctuate from year to year based on weather and management efforts. Backpack sprayers were used for the outer southern levee as it is only accessible via boat. A truck mounted spray rig was used to treat the more accessible western, eastern, and northern levees. During follow-up treatments, individual patches or plants will be treated and mapped and reductions in populations should be visible over time.

The life history and treatment strategy for each invasive species treated are discussed in the following sections.

PERENNIAL PEPPERWEED

Description

Perennial pepperweed (*Lepidium latifolium*) is an herbaceous perennial plant native to Eurasia in the family Brassicaceae. When in flower, it has a dense cluster of white flowers at the top of stems three to eight feet tall. Stems and leaves are dull gray-green and waxy, sometimes with reddish spots (Bossard et al. 2000).

Perennial pepperweed is rated as highly invasive with a high statewide impact by the California Invasive Plant Council (Cal-IPC 2006). The California Department of Food & Agriculture (CDFA) currently lists perennial pepperweed as a class B noxious weed, meaning the plant is known to cause economic or environmental detriment but has limited distribution (CDFA 2016).

Life History

Perennial pepperweed reproduces from seed, as well as vegetatively from intact root systems or from pieces of rootstock. New plants readily grow from pieces of rootstock less than one third of an inch in diameter and less than one inch long. Flowering time varies from May to July in different parts of California. Seeds mature by June or July. Seeds likely spread via wind, water, and wildlife and may be viable for more than two years. Seedlings grow rapidly and can produce flowering stems the first year. In fall and winter aerial stems die back to the ground, and new shoots sprout in the spring (Bossard et al. 2000).

Distribution and Impacts at Sears Point

Perennial pepperweed is widespread throughout San Francisco and San Pablo Bay estuaries and occurs in both saline and freshwater wetland environments and adjacent uplands. Once established, populations can grow rapidly, forming dense mats of tall stems that grow taller than typical native salt marsh vegetation. Patches may spread approximately six to ten feet per year depending on habitat type (Hogle et al. 2007).

Dense stands of perennial pepperweed overtop shorter-statured native salt marsh vegetation, which can ultimately outcompete and displace native species. High densities of large roots also reduce soil compaction (Renz 2000) which can lead to increased soil erosion and instability along levees, further driving the invasion by non-native species and reducing native plant species diversity. Wildilfe impacts are lesser known. PRBO Science monitored the impacts of perennial pepperweed in the South Bay in 2004 and found minimal impacts to native bird species or even enhanced nesting success for some species (Spautz & Nadav 2004). Perennial pepperweed's impact on native salt marsh vegetation is thought to have a much greater impact on the rare species inhabiting tidal habitats, primarily pickleweed-dependant species such as the salt marsh harvest mouse and clapper rail.

At Sears Point, perennial pepperweed numbers are currently small. Since the restoration of tidal wetlands, perennial pepperweed has been treated at a maintenance level in nearby locations by the USFWS to prevent establishment of dense stands. Perennial pepperweed will continue to establish small populations throughout the site as long as tidal influence remains and nearby populations are not controlled. The USFWS intends to

continue annual maintenance of this species as part of regular management on the San Pablo Bay National Wildlife Refuge.

Control Strategies

Herbicide

Manual and mechanical methods have been well documented as ineffective at control and often result in increased abundance and density of perennial pepperweed (Young et al. 1995) therefore herbicide methods are currently the best management practice for pepperweed control in most environments. Perennial pepperweed is susceptible to numerous herbicides but only a few products are labeled for use in tidal wetlands. Glyphosate and imazapyr are both amino acid inhibitor herbicides that have similar modes of action and each has several aquatic formulations that are labeled for tidal wetland management (Rodeo™/Roundup Custom™, and Habitat™/Polaris™ respectively). Both are very effective alone and in combination on perennial pepperweed. Imazapyr may have some advantage over glyphosate as in some field trials it appeared to have less impact on native pickleweeds. Imazapyr also has the benefit of residual soil activity in drier areas and soils without tidal flooding (residual activity is moot in tidally flushed soils). This residual activity is especially beneficial when treating a plant like perennial pepperweed whose main means of propagation is vegetative growth, sprouting from its large, branching root masses. Both herbicides are most effective when applied at the time of flowering to allow for maximum translocation into the plant's storage tissues. Since many life stages are generally present during the time of treatment, complete control is challenging and many years of repeated treatments are necessary for full control.

The most challenging element in perennial pepperweed treatment is that it is extremely difficult to find small and non-flowering populations in a tidal marsh. This species can occur over nearly the entire range of elevation and salinity gradients found at the Sears Point, and its seeds are dispersed by tidal flow so it can occur almost anywhere in the marsh environment. Treatments conducted by Shelterbelt Builders have focused on the edges of levees and channels and along the outer wrack line along the San Pablo Bay shoreline.

2016 Control Summary

Shelterbelt controlled pepperweed during three visits from May 24 until June 15. Backpack sprayers were used for the outer southern Bay-front levee as it is only accessible via boat. A truck mounted spray rig was used to treat the more accessible western, eastern and northern levees. All treatments utilized the aquatic formulation of the herbicide imazapyr.

YELLOW STAR THISTLE AND STINKWORT

Description

Yellow star thistle (*Centaurea solstitialis*) is a non-native annual thistle in the family Asteraceae, thought to be one of the most damaging rangeland weeds in California. Yellow star thistle is distinguished by its characteristic inch-long sharp spines that emerge to protect each flower bud in the early spring/summer.

Yellow star thistle is rated as highly invasive with a high statewide impact by the California Invasive Plant Council (Cal-IPC 2006). The CDFA currently lists yellow star thistle as a class C noxious weed, meaning the plant is known to be of economic or environmental detriment and is relatively widespread throughout the state (CDFA 2016). There is no regulatory control action enforced by the CDFA other than for pest cleanliness standards on imported nursery stock.

Stinkwort (*Dittrichia graveolens*) is an annual herb in the family Asteraceae, native to Europe and Asia. The plant is sticky, highly aromatic and poisonous to people and livestock. It generally has one central stem with many branches, and small narrow leaves. The leaves and flowers are sticky glandular and its common name alludes to resulting aromatic qualities similar to camphor. The small flower heads have yellow ray flowers and yellow to red disk flowers, and seeds have a single row of pappus bristles (Jepson Flora Project 2012; DiTomaso and Healy 2007).

Stinkwort is listed as an invasive species with a moderate statewide impact by the California Invasive Plant Council. It is also listed as a red-alert species due to rapid population and range expansion observed in recent years in numerous California counties, so impacts may increase in the future (Cal-IPC 2006; DiTomaso and Healy 2007; Brownsey et al. 2012). The California Department of Food & Agriculture (CDFA) currently lists stinkwort as a class B noxious weed, meaning the plant is known to cause economic or environmental detriment but has limited distribution (CDFA 2016).

Life History

Yellow star thistle reproduces only from seed. Seed dormancy is minimal (one to three years) in California populations of yellow star thistle and 80 to 90 percent of seed germinates during the first year (DiTomaso 2006). Multiple seed germination periods are apparent in the populations at the Sears Point. Seeds begin to germinate in fall or early winter, and young plants grow as tap-rooted rosettes until bolting occurs in late spring or early summer (Bossard et al. 2000).

Adult plants reach varying heights (two to four feet) based on available soil moisture and nutrient availability. Plants generally flower from May to September. When adequate moisture is available, yellow star thistle can survive as a short-lived perennial and flower throughout fall, winter, and spring (Bossard et al. 2000).

Most seed from yellow star thistle is likely to disperse relatively close to the parent plant in a natural system. Long range dispersal mechanisms are currently unknown though they likely have more to do with anthropogenic factors than other abiotic factors such as wind, water, or wildlife. Poor industrial hygiene and agricultural practices are likely to be the main vector for long range dispersal. Plant seed is spread readily on livestock, hay bales, vegetation management along rights-of-way, and the movement of fill soil and gravel.

Stinkwort is a late-season annual, flowering September through November (Jepson Flora Project 2012). Flowering is triggered by a change in photoperiod in early September, as opposed to changes in soil moisture or other triggers. Seedlings can germinate throughout the winter and early spring, then remain in the basal rosette stage until May, with most stem growth occurring in August and September. Stinkwort disperses by seed only and the sticky, barbed pappus and hairy seeds allows seeds be dispersed by wind, water and by attaching to people, animals, and machinery (Parsons and Cuthbertson 2001). This species is likely to have short-lived seeds with no dormancy (Brownsey et al. 2011). Due to stinkwort's presence both along roads and in seasonal wetlands and vernal pools, it appears to have a wide tolerance of soil moisture levels, soil compaction, and flooding (Brownsey et al. 2012).

Distribution and Impacts in the Sears Point

Yellow star thistle is abundant in seasonal wetlands, grasslands, and levee areas in the Sears Point tidal wetlands project area. It is distributed throughout the site's uplands and drier seasonal wetlands with the largest patches occurring along levee slopes and tops and along the SMART railway right-of-way.

Yellow star thistle is a serious pest in grasslands. Untreated, it forms dense stands in annual grassland and disturbed habitats that can often impede pedestrian access. In these grasslands, yellow star thistle steadily outcompetes and displaces other plant species throughout much of its life cycle - from its dense seedling

germination phase to its basal rosette phase – resulting in a grassland area with much reduced botanical diversity. Later season yellow star thistle growth still has a relatively open canopy compared with more dense native perennial grassland (such as creeping wild rye) resulting in poor grassland nesting habitat for ducks and other waterfowl.

Stinkwort is commonly observed along roadsides and also invades disturbed fields, pastures, levees, riparian woodlands, disturbed vernal pools, and tidal marsh margins. At Sears Pont, it is currently present along both inboard and outboard slopes of the main levees and along the railroad right-of-way. Regionally, it is currently present along most major roadways, pastures and other disturbed areas.

Surrounding Sonoma Land Trust properties support rangeland and hay production. The unabated growth of both yellow starthistle and stinkwort at Sears Point subjects these valuable agricultural properties to increased weed pressure that ultimately results in reduced crop yields, reduced values in contaminated hay, and reduced forage for beef and dairy cattle.

Control Strategies

Yellow star thistle is a high priority for management in levee and grassland areas where the species restricts access and impedes habitat restoration efforts. Pilot control efforts from 2010-2012 by Shelterbelt Builders and the USFWS tested three methods of landscape-level control on levees in the and in grasslands at the adjacent Sonoma Baylands: mowing, fall herbicide application, and spring herbicide application. Herbicide was selected for control at Sears Point as it is much more efficient than other methods and is more easily combined for the treatment of multiple species during a single maintenance visit.

Herbicide

Both summer/fall and spring herbicide applications can be an effective component of an integrated approach to control large stands of yellow starthistle and stinkwort at the Sears Point. Summer/fall applications with glyphosate or imazapyr, like mowing, must be timed based on the appropriate plant phenology during periods when the plants are cycling stored carbohydrates to their roots. The effectiveness of these applications is subject to many of the same limitations as mowing though it is slightly less limited to a single growth stage. Late-season applications of glyphosate and imazapyr are generally effective from the bolt stage to early flowering stages (DiTomaso et al. 2006). Using glyphosate when plants are in full bloom may still allow some flowering heads to ripen to produce seed.

Spring applications used selective herbicides like aminopyralid (Milestone™) that are active over a greater period of time from germination to seedling life stages. These products are designed to have a small degree of residual soil activity (meaning the plants can take up the products through their roots up several months after the date of application) which makes timing the applications less critical for effective control, even for multiple generations in a single year. These applications are often more effective as they allow for less escapement as the environment rather than the individual plant is treated. Overall, they utilize much less herbicide to cover similar areas than fall applications and often offer increased efficiencies as tractor/truck mounted boom sprayers can be utilized.

Many herbicides have been used for controlling stinkwort in Australia over the last century. In a review of Australian pesticide labels, 2,4-D and MCPA products were the most frequently listed for controlling stinkwort (Dow Agro – Australia, NuFarm/Monsanto – Australia). Newer products such as aminiopyralid, clopyralid, and triclopyr have no label references in either Australia or the United States but they have potential to be effective. The USFWS staff of San Pablo Bay National Wildlife Refuge has successfully used imazapyr (as Habitat™) to control patches of flowering stinkwort without producing viable seeds (Marriott 2010).

2016 Control Summary

As the Shelterbelt contract started after the spring application window, we were limited to treating yellow starthistle with summer/fall application methods. Our treatment window extended from July 1 through August 10; shifting to sites that demonstrated the appropriate plant phenology for each treatment. We used a combination of glyphosate and imazapyr depending on site conditions and other species we were controlling concurrently. Plants matured near the tidal areas much later than plants in interior areas which made for a long window of control.

Stinkwort was found in many of the same locations as yellow starthistle so we treated both species concurrently. Overall, 2016 treatments encountered small populations of both these species diffused over nearly the entire site. Treatment of these species was very labor intensive. Our goal was to reduce the population for 2016 until we could use more efficient spring herbicide methods in early 2017.

PACIFIC BENTGRASS

Description

Pacific bentgrass (*Agrostis avenacea,* synonym: *Lachnagrostis filiformis*) is a tufted annual grass from Australia in the family Poaceae that can occur as a short-lived perennial in wetland environments. The spikelets are in a relatively open, spreading inflorescence with long awns that help to transport seeds via wind. This morphology leads to its habit observed in its native Australia of creating massive accumulations of seedheads that block equipment air intakes, roads, and railways and knock down fences and structures by increasing wind loads.

Pacific bentgrass is rated as an invasive species with limited statewide impact by the California Invasive Plant Council (Cal-IPC 2006). The CDFA does not currently list this species as a noxious weed (CDFA 2016).

Life History

Unlike some *Agrostis* species, Pacific bentgrass does not have rhizomes or stolons so its primary mode of invasion is by seed. This annual species flowers in June and July in California (Jepson Flora Project 2012), with seed presumably dispersing in July and August. Each plant is capable of producing up to 14,000 seeds; approximately half the seeds drop off near the parent plant and the other half remain in the windblown inflorescence to be dispersed over longer distances (Warnock et al. 2008). Pacific bentgrass is a specialist colonizer of disturbed or barren soils associated with seasonal wetlands (Gosney et al. 2006). It is salt and flood tolerant.

Distribution and Impacts in the Sears Point

In California, Pacific bentgrass most often occurs in temporarily-flooded habitats such as vernal pools and seasonal wetlands (DiTomaso and Healy 2007). In the vicinity of the Sears Point, it appears to become most abundant in disturbed habitats such as constructed seasonal wetlands and tidal channels, fallow diked croplands, or edges of farms subject to repeated disturbance (disking, levee and road repairs, etc.) (Meisler 2012; and pers. obs. by Shelterbelt Builders). Currently, the Sears Point population is restricted to the disturbed inboard slopes of the interior levee in active revegetation zones and in three small patches in seasonal wetland areas.

This competitive annual grass is highly exclusive in moist bare ground areas such as vernal pools. As it develops into a thick, heavy thatch, it can exclude native and rare annual forbs that typically populate vernal pools (Bauder 2009). In disturbed restoration areas along levees, it is likely to be ephemeral. Native shrubs would likely exclude it after developing a closed-canopy.

Control Strategies

In Australia, Pacific bentgrass is often considered a nuisance pest plant around seasonally dry lake beds, and it is commonly controlled with herbicides and mowing. Physical barriers, grazing, and mowing have also been used to manage Pacific bentgrass (Warnock et al. 2009). The effectiveness of these methods is discussed below. Since it is a native plant in Australia, this species is generally managed to minimize mass dispersal of seed heads to prevent property damage and other nuisance problems, rather than trying to eliminate the plant completely.

Herbicide

Late-season applications with glyphosate herbicides are also widely used in Australia to manage seed dispersal. The plants are sprayed when flowering spikelets are beginning to produce seed, which kills the plants but allows some seed to ripen – though in much smaller numbers than without any control. Again, this technique is used to restrict the spread of the plant rather than to eliminate populations.

The most effective removal methods for small populations appear to be early spring glyphosate herbicide applications (Warnock 2009) and hand pulling (Bauder 1996). Extremely small populations in Southern California vernal pool systems have been hand weeded with some degree of success but due to the time required, this tool is limited to very small populations or volunteer or low-cost labor.

Early-season glyphosate application is likely the most cost- and biologically-effective means for patch elimination for small- to medium-sized populations. Since standing water may be present in seasonal wetland areas in the early growing season of Pacific bentgrass, aquatic formulations of glyphosate such as Rodeo™ or Roundup Custom™ should be used, along with aquatic-approved surfactants. Generally, established stands of Pacific bentgrass are likely to be monocultures even at early development stages due to large numbers of seed dropped from previous generations, so non-selective herbicides such as glyphosate are expected to have few non-target impacts when applied on existing patches. Glyphosate applications should be applied when most surface water has receded but before the plants have grown more than six inches tall. This allows the herbicide to be effective at the lowest labeled rates. Several spray events may be necessary depending on the late-season rains and seedling emergence.

2016 Control Summary

Shelterbelt's contract started after Pacific bentgrass had gone to seed. We did not control this species in 2016. The first control is planned for spring 2017.

SUMMARY OF WEED MANAGEMENT STRATEGY

The low gradient slopes of Sears Point levees represent an emerging trend in tidal wetland restoration in the San Francisco Bay Region. These larger transition zones have the opportunity to restore larger expanses of diverse native shrub communities that offer high tide refugia to imperiled tidal marsh species such as clapper rail and salt harvest mouse. They also represent a larger challenge to establish viable native plant communities in challenging environments.

Revegetation of the tidal wetlands of the Sears Point will be allowed to occur naturally as tidal plants are fully capable of establishing in restored marshes voluntarily with tidally dispersed propagules with little disruption from invasive species. The levees, however, are unnatural constructs that require much more active management and restoration. Salvaged soils, variable salinities, and high levels of environmental exposure all pose certain challenges. These sites require adequate site preparation, supplemental active revegetation with live plants and seeds, and diligent weed management.

Diligent weed management does not necessarily mean attempting complete eradication of these species. Complete eradication of the species of primary concern is likely impossible due to the configuration of the Sears Point tidal wetlands project and the number of physical elements that contribute weeds onto the site. Currently the site is surrounded by farmland, industrial areas, and San Pablo Bay, and all are intersected by service roads and an active rail right-of-way.

Some weeds may be tenacious and harmful (yellow starthistle) while others may restrict themselves to recently disturbed locations and bare ground areas (Pacific bentgrass). Attempting to control all the non-native species present can be overwhelming and ultimately unsuccessful, so we developed a strategy to ensure the most efficient use of resources. The strategy is built upon two principles. First, instead of managing against weeds, our philosophy is to manage for the native communities we desire. With this spirit, we identified weed species that have the potential to interfere with natural and supplemented revegetation efforts. Second, to minimize the total, long-term weed control workload, our strategy focuses on containing the spread of plants with expanding ranges and controlling smaller, isolated populations. For the next three years, our management will focus on weed populations that are the fastest growing, most disruptive, and affect the most highly valued areas of the site.

Summary of Weed Control Strategies

Perennial Pepperweed. Pepperweed is currently present mostly on the Bay-side southern levee in very low densities. Our strategy is to use spot spraying with backpack sprayers to maintain populations at very low levels so they do not impede native plant establishment on the levees or spread to any other neighboring levees.

Yellow starthistle & Stinkwort. Both of these late summer growing annuals represents the larger challenge for facilitating levee revegetation. Both are opportunistic spreaders when there is bare ground and little push-back from native plant competition. Our strategy is to confine each species to existing areas and manage for small populations. Yellow starthistle offers the greatest chance for control since adjacent populations are limited. Stinkwort is a regional problem and disperses widely over large areas.

Spring applications of aminopyralid will be used early in the control period where we can achieve maximum efficiency and knock-down of the current populations. As native plants begin to fill-in along the levees, we will shift to spot spraying with glyphosate as the populations decrease.

Pacific bentgrass. Our contract started after the bentgrass had seneced so it was not treated in 2016. Treatment will begin in the spring/summer of 2017. We plan to limit its spread in the disturbed levee zones to facilitate native revegetation.

Other weeds. Iceplant and New Zealand spinach were both treated as they were found in the project area. Isolated patches of these plants are mostly found on the Bay-side southern levee system. These species are regarded as a lower priority as they don't have the tendency to spread to the degree of the higher priority species. They are however treated when found.

APPENDIX J

TABLE: 2016 herbicide use on Sears Point tidal wetland levees by Shelterbelt Builders Inc.

Date	Applicators (last names)	Target species	Net area treated	Gross area treated	Equipment used	Product	Total gal. mix	% mix (v/v)	**Oz used**
5/24/2016	Brubaker, Siram	perennial pepperweed	0.1 acre	4 acres	backpacks	Polaris	0.75	3%	2.88
5/25/2016	Adamo, Heath, Brubaker	perennial pepperweed, yellow starthistle, stinkwort	1.5 acres	25 acres	backpacks, utv spray rig	Polaris	34.5	3%	132.48
6/15/2016	Brubaker, Heath	perennial pepperweed, yellow starthistle, stinkwort	1 acre	35 acres	backpacks	Polaris	2	3%	7.68
7/1/2016	Brubaker, Protos	perennial pepperweed, yellow starthistle, stinkwort	3 acres	75 acres	double reel spray rig	Roundup Custom	73	2.25%	210.24
7/21/2016	Protos, Nolte	perennial pepperweed, yellow starthistle, stinkwort	7 acres	75 acres	double reel spray rig	Roundup Custom	155	2%	396.8
7/25/2016	Brubaker, Protos	perennial pepperweed, yellow starthistle, stinkwort	3 acres	75 acres	double reel spray rig	Roundup Custom	29	2%	74.24
8/4/2016	Brubaker, Jones, Swagler	stinkwort	3 acres	6 acres	Backpacks	Roundup Custom	18	2%	46.08
8/9/2016	Brubaker	yellow starthistle, stinkwort	3 acres	6 acres	Backpacks	Roundup Custom	21	2%	53.76
8/9/2016	Brubaker	yellow starthistle, stinkwort	3 acres	6 acres	Spray rig	Roundup ProMax	19	4%	97.28

APPENDIX J


Shelterbelt Builders INC
Open Land Management & Restoration
415-357-1500
Sears Point Annual Weeds Treated in 2016 for Sonoma Land Trust
Species treated: stinkwort (Dittrichia graveolens) and yellow star thistle (Centaurea solstitialis)
N
E
0 200 400 meters
Legend
Early-season 2016 treatment with Polaris (May-June)
Mid-season 2016 treatment with Roundup (July-August)
Sears Point boundary (approximate)
Imagery: Google Satellite

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