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Upper Los Angeles River Watershed Strategic Implementation Plan for *Arundo donax* Treatment and Eradication

PREPARED FOR

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PREFACE

The Upper Los Angeles River Watershed Strategic Implementation Plan for Arundo Treatment and Eradication offers an opportunity to articulate and pursue common goals systematically and at scales ranging from headwaters and tributaries to watershed-wide. It is a *living document* developed by individuals involved in Arundo treatment and is intended to guide practitioners in watershed protection, management, and restoration by describing desired conditions and by providing a roadmap towards these conditions. This roadmap includes specific guidance as well as lessons learned. The geographic scope for the Strategic Plan includes the Upper Los Angeles River Watershed with open collaboration to reach adjoining watersheds. The Strategic Plan has a greater footprint for downstream water users. The value of water flowing from federal, state and private lands has become increasingly important, especially where severe drought continues.

This Strategic Plan provides the guidance necessary to achieve an ambitious and effective course of action to increase rates of Arundo treatment. The content presented in the Strategic Plan aims to identify a purpose, set of goals, and a series of actions aimed at increasing the pace, scale and efficacy of Arundo treatment toward Arundo eradication through coordinated permitting, planning, funding, and stakeholder involvement and partnership capacity. To achieve the target of removing 180 acres of Arundo in the 514 square mile Upper Los Angeles River Watershed in a 10 year period will require an all-hands, all-lands approach involving people, institutional change, improved coordination, as well as perseverance. The targeted 180-acre Arundo treatment includes a National Forest Foundation 100-acre Arundo removal program currently taking place in the Upper Tujunga Wash and approximate 164-acre Arundo removal projects by the U.S. Army Corps of Engineers (USACE), County of Los Angeles, and other municipalities leaving 16 acres of privately-held arundo infested areas outside of Angeles National Forest, USACE, County and other municipal-owned lands. The Strategic Plan is intentionally ambitious. However, a pathway does exist to increase the pace, scale and efficacy of Arundo treatment throughout the Upper Los Angeles River watershed.

By reaching consensus on a path forward, a diverse group of agencies, scientists, and stakeholders can more effectively leverage necessary resources and the strategic changes required to increase the pace, scale and efficacy of Arundo eradication in the Upper Los Angeles River Watershed.

We invite all stakeholders to read the Strategic Plan and join the Upper Los Angeles River Arundo Eradication Team in restoring and conserving our watersheds to provide and to restore a healthier and more resilient landscape within the next 10 years.

1 INTRODUCTION

1.1 Background

The Upper Los Angeles River (ULAR) Watershed encompasses 514 square miles and is located primarily in LA County, with a small portion of the western watershed in Ventura County (Figure 1-1). The ULAR begins as headwaters in the San Gabriel Mountains of the Angeles National Forest; encompasses Big Tujunga Creek, Little Tujunga Creek and washes, Pacoima Wash, Hansen Dam, and the San Fernando Valley, and ends at the Los Angeles River - Arroyo Seco confluence, as shown in Figure 1-2 (USACE, 2005). The Arroyo Seco is an upper tributary of the Los Angeles River, located outside of and east of the project area and south of Tujunga watershed. The Los Angeles River and its floodplain have been significantly altered by flood protection infrastructure, water diversions and flow regulation, roads, urbanization, non-native invasive plants/wildlife, and wildfires. Climate change has exacerbated the intensity of droughts, with California seeing both record-breaking high temperatures and record low rain and snow fall in recent years, leading to severe water deficits for Los Angeles and surrounding communities (OEHHA 2018). With regular droughts and the wildfire season lasting year-round, it is crucial that water resources are conserved to the greatest extent possible. The presence of the non-native invasive species *Arundo donax* within the ULAR is a major obstacle for both water conservation and wildfire management.

The Council for Watershed Health (CWH) Arundo Eradication program aims to remove 180 acres of Arundo from areas that directly impact water availability for Los Angeles both within the city and the surrounding San Gabriel, Santa Susana, and Santa Monica Mountain ranges in conjunction with a National Forest Foundation 100-acre Arundo removal program currently taking place in the Upper Tujunga Wash (see Appendix B). This targeted Arundo eradication will prohibit its spread downstream into high profile Los Angeles River restoration projects and will result in significant water savings of approximately 1600 acre-feet of water per year (AFY) (Giessow et al. 2011). In addition to water savings, Arundo removal from the ULAR will significantly reduce the likelihood of high intensity wildfires and their associated impacts. The dead and dry stems of Arundo stands are a fuel source that feeds wildfires, which increases their intensity and destructive capacity. Dense Arundo stands constrain and disrupt natural geomorphic and hydrologic processes, often causing riparian and aquatic habitat loss or degradation. Despite these current challenges, the Upper Los Angeles River riparian corridor presents a unique opportunity to conserve and restore riparian functions and ecosystems. The upper watershed and tributaries continue to support a variety of natural aquatic and terrestrial communities and native species (Figure 1-3). It also provides regionally significant wildlife corridors among protected terrestrial wildlife areas in the southern California coastal ecoregion. The river and its tributaries provide important aquatic and riparian habitat linkages to adjacent watersheds and from the coastal estuaries, lagoons, and wetlands to upstream habitats in the mainstem channel and its tributaries that reach up into the mountains of the Angeles National Forest.

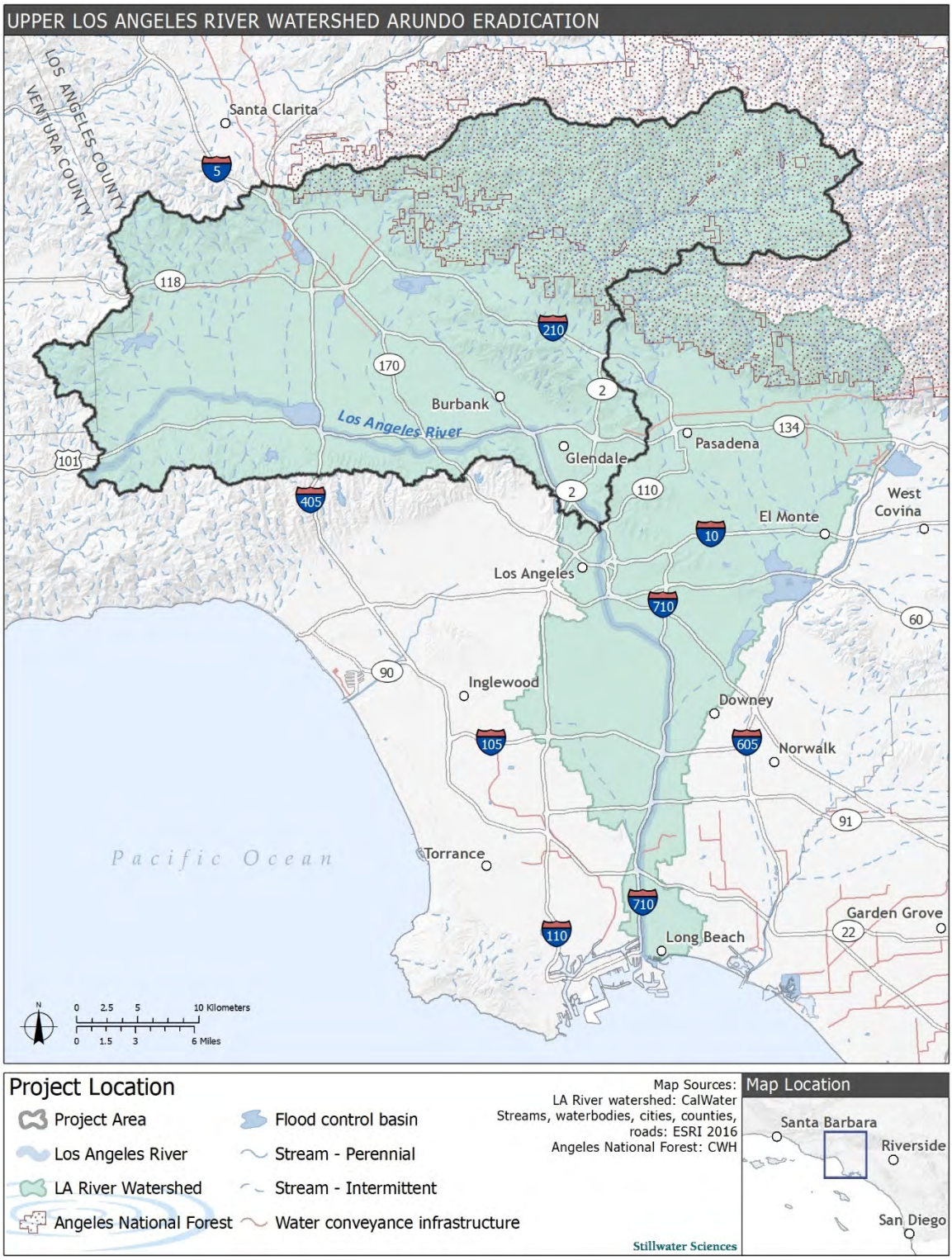

Figure 1-1. The Los Angeles River Watershed.

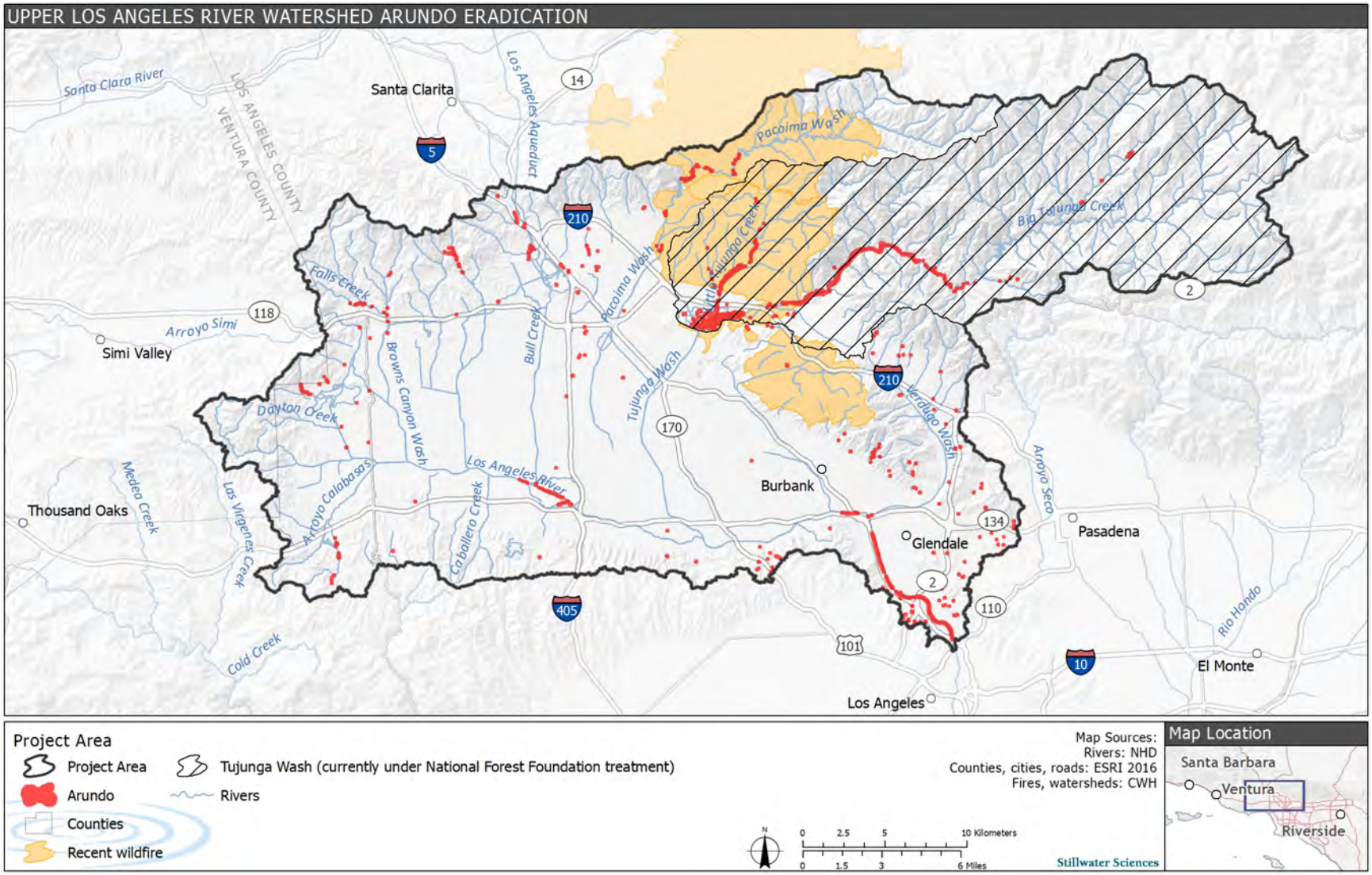

Figure 1-2. Upper Los Angeles River Arundo Eradication project area.

Arundo is a highly aggressive, naturalized landscape plant that is a relative of bamboo and invades riparian zones by establishing dense, monospecific clonal stands (DiTomaso and Healy 2007). It is widely distributed in the watershed, spreads quickly (it establishes by vegetative propagules, most often rhizomes that wash downstream from eroded banks (DiTomaso and Healy 2007), and severely impacts the ecology of the riparian corridor (Stillwater Sciences and URS 2007).

- **Increased fire risk:** Dry and dead Arundo stems, or canes, create a thick, dry fuel source and are highly flammable. Arundo has been shown to increase the likelihood and intensity of fire in Southern California riparian corridors (Coffman 2007, Coffman et al. 2010, Geissow et al. 2011). In addition, Arundo is shade-tolerant and has established under the canopy of native vegetation. This exposes native riparian trees, which are much less tolerant of fire, to increased fire threat, contributes to the spread of wildfires from and between drier upland vegetation communities, and reduces the function of the riparian corridor as a natural barrier to fire. Arundo also re-sprouts vigorously after fire by quickly exploiting released nutrients, allowing it to outcompete and replace native plant species (Coffman 2007, Coffman et al. 2010). Past and potential future fires along the Los Angeles River, such as the Creek Fire that burned approximately 34% of the watershed in December 2017, are likely to increase the cover and extent of Arundo along the riparian corridor and exacerbate the Arundo-fire cycle (Batman 2018, OEHHA 2018, Lambert et al. 2011).
- **Reduced water availability:** Arundo is a hydrophyte and uses a large amount of water to supply its very high growth rate (Bell 1997, Geissow et al. 2011). A variety of studies in the arid west have demonstrated that, based on its evapotranspiration rate, Arundo uses anywhere from two to three times more water than native riparian plant species (T. Dudley personal communication June 27, 2018).
- **Reduced flood capacity and altered geomorphology:** Large stands of Arundo obstruct river flow, increase stream roughness, and create debris dams at bridge crossings, thereby increasing the risk of flooding, bank erosion, and damage to infrastructure (DiTomaso 1998, Coffman and Ambrose 2011). In a study of several modeled Southern California stream channels, large stands of Arundo were found to significantly reduce flood capacity and alter river geomorphology (NHC 2011).
- **Degraded wildlife habitat:** Arundo is a strong competitor in systems with increased nutrient supply, and heavy fertilizer use may be an important factor aiding its dominance over native riparian plant species (Coffman 2007). It outcompetes native plant species such as willows, mulefat, and cottonwoods, which provide bird nesting habitat for protected least Bell's vireo (*Vireo bellii pusillus*) and southwestern willow flycatcher (*Empidonax traillii eximus*) (Bell 1997, Kisner 2004, Coffman and Ambrose 2011). Silica in Arundo leaves and stems reduces herbivory by many native insects and grazers, and its dense growth form can physically restrict wildlife movement through the riparian corridor (Jackson and Nunez 1964 and Kisner 2004, as cited in Coffman and Ambrose 2011).

In the same way that Arundo has a multitude of impacts on riparian ecology, treatment of Arundo can have a variety of benefits. Reducing the amount of Arundo in and adjacent to the riparian corridor can help disrupt the Arundo-fire cycle and reduce the risk, extent, and intensity of wildfires. Studies have estimated that treatment of Arundo can increase the amount of water available for both ecosystem and human uses, and that the cost of Arundo treatment is far outweighed by the benefit in water savings (Seawright et al. 2009, Geissow et al. 2011). Thus treatment of Arundo in the ULAR will provide the opportunity for native vegetation to reestablish

and improve the quality of riparian habitat for many wildlife species and increase the resilience of this watershed to stressors such as wildfire and drought.

Figure 1-3. Locations of listed species and native habitat linkages in the ULAR Watershed. Note: Green and red lines represent locations of listed species and native habitat linkages (Sources: CNDDB and Stillwater Sciences, 2018)

Guidance for ULAR Watershed Arundo Treatment:

- Conduct removal projects from upstream to downstream and in tributaries. These areas have lower risk of reinfestation and treatment in these areas reduces the supply of propagules to downstream areas.
- Prioritize upland or transition zones between riparian areas and upland areas for removal to reduce the supply of propagules to lower areas and to reduce the risk of fire spreading to the riparian corridor from adjacent upland vegetation types.
- Prioritize watersheds with low nutrient supplies, since these areas are less likely to favor Arundo reestablishment over native species.
- Conduct removal projects in early summer following winter or spring flood events when biomass has already been washed downstream, making it easier to access, cut, and treat the plants.
- Conduct removal projects after fires to take advantage of biomass loss and to suppress rapid Arundo regrowth following fires.
- Generally, perform removal projects outside the breeding season (mid-March to late September) of bird species that may use Arundo or adjacent native riparian species as nesting habitat. If removal projects will occur within the breeding season, a pre-treatment bird survey should be performed to confirm there are no nesting birds in the treatment area.
- Finally, where removal of large tracts of Arundo is targeted, plan for phased removal, followed by rapid revegetation to minimize the period and extent of reduced nesting habitat availability for scrub-nesting birds.

While initial mapping efforts provide a large-scale overview of the priorities for Arundo treatment, the lack of a detailed and spatially explicit strategy has made it difficult for CWH to assign fine-scale priorities necessary for efficient Arundo treatment. Assigning fine-scale prioritization within the project area will provide a methodology to guide project implementation. Clear methodology to achieve Arundo eradication in ULAR is also necessary for funding acquisition and aids in attaining cooperation between federal and local agencies. CWH has sought a comprehensive scientifically supported investigation of Arundo infestation in the ULAR in order to provide a pragmatic strategy to pursue its eradication and to attain funding necessary to implement the strategy.

This Strategic Plan describes Arundo treatment to restore native riparian habitat for parcels in the ULAR project area, as defined below, along with permit and cost information and treatment priorities.

1.2 Goals and Objectives

The primary goal of this Arundo Treatment and Eradication Strategic Plan is to provide the information necessary for CWH and project partners to select and acquire funding for specific Arundo treatment as well as multiple benefit integrated water management projects such as native riparian habitat revegetation/restoration projects in the ULAR watershed project area. Specific objectives to support this goal are to:

- Identify effective and appropriate Arundo treatment approaches for ULAR project area lands.
- Identify maintenance requirements, costs, and permits associated with those methods.

- Identify specific areas for the application of treatment methods and priorities for treatment on existing ULAR project area parcels, using existing spatial data sets (e.g., Arundo percent cover, riparian vegetation, and flood frequency) and field reconnaissance.
- Identify potential funding sources to address Arundo treatment, management, and monitoring costs.

In addition to these near-term objectives, CWH and project partners are interested in using this Strategic Plan and resulting Arundo removal projects to engage and partner with other relevant public agencies as well as private landowners to increase the scale and pace of the Arundo treatment effort. Coordinating this Strategic Plan with on-going efforts and other plans, such as the Upper Tujunga Wash Arundo eradication program upstream of the project area, is also an important goal for CWH, and relevant information on such existing programs will be incorporated into the ULAR Arundo Treatment and Eradication Strategic Plan.

1.3 Project Area

The project boundaries for the Upper Los Angeles River (ULAR) Watershed Arundo Eradication program lie within the geographic boundaries of the ULAR, representing 514 mi^2(Figure 1-1). Arundo is pervasive throughout the ULAR: recent mapping indicates approximately 180 acres have significant coverage within the project area. Existing surveys are highly detailed and provide sufficient data on distribution, % cover, and treatment status. Additional ground reconnaissance may be needed in specific forested areas (Upper Pacoima Wash) with high canopy cover for Arundo eradication.

The ULAR Watershed project area is bordered by the Santa Susana and San Gabriel Mountains to the north, Santa Monica Mountains to the south, the Arroyo Seco (an upper tributary of the ULAR) to the east, and Simi Hills to the west. The upper portion of the watershed is forest and open space, while the remaining portion within San Fernando Valley and surrounding communities is highly developed with commercial, industrial, or residential uses (USACE 2005). Portions of the project area have recently been impacted by the Sand, Creek, and La Tuna Fires in the northeastern range (Figure 1-2). These fires have left large portions, upwards of 34%, of the Los Angeles River watershed, barren of vegetation and thus prone to establishment of Arundo stands (Batman 2018, Coffman et al. 2010). These burn-impacted river reaches lie in the upstream reaches of the watershed, and so Arundo establishment and spread in these upstream burn-impacted areas could become important propagule sources that could re-establish in treated downstream reaches within the ULAR (Figure 1-2).

Upper tributaries of the Los Angeles River include the Arroyo Seco, whose headwaters originate in the San Gabriel Mountains and is outside of the project area, the Pacoima and Tujunga Washes in the San Gabriel Mountains, and Verdugo Wash in Glendale (California Resources Agency 2001). The Los Angeles River's channelized portion in western San Fernando Valley flows through the San Fernando Valley eastward into the northern corner of Griffith Park. The Los Angeles River then turns to the south, through the Glendale Narrows, and continues until it reaches San Pedro Bay near Long Beach, thus draining a total area of 834 mi^2 (USACE 2005). The Los Angeles River is predominantly a concrete channel, with 47.9 of its 51-mile length being lined with concrete (LADPW 2007).

Consistent with other rivers in the region, the Los Angeles River watershed experiences highly variable annual rainfall and peak river flows. Annual rainfall averages range from 27.5 inches in the mountains to 12.2 inches along the coast (CRWQCB 2010). Historically, during the dry

summer season, flows in the mainstem and tributaries are intermittent or non-existent, with approximately 80 percent of the dry season flow originating from point source discharges and the remaining 20 percent originating from nonpoint discharges into storm drains and smaller amounts from ground to surface water inputs (USACE 2015). However, due to consistent discharge from treatment plants, dry weather flow to the ULAR contributes to large amounts of Arundo in the Glendale Narrows. The wet season of October through April results in flows up to 1,592 CFS--varying considerably from the headwaters to the estuary (CWH 2012). During winter rainfall events, flows can increase, peak, and subside rapidly. High rainfall input rates that exceed infiltration capacity create saturated or near-saturated conditions and can lead to severe flooding in some areas. As mentioned above, dense Arundo monocultures reduce channel capacity and can exacerbate high flow impacts.

2 ARUNDO TREATMENT METHODS AND COSTS

Initial investigations into Arundo treatment costs revealed a wide range of costs/acre, depending on the project region, project size, methods, permitting effort, degree of Arundo infestation, and other factors (Appendix A). Several Arundo treatment experts with experience in the region were interviewed to identify the most effective treatment methods, the most important determinants for cost, and costs per acre for treatment methods and site conditions that would be characteristic of the ULAR watershed. Section 4.2 as well as Appendices B and C contain details on interviews conducted with Edward Belden from NFF, Jason Giessow with DENDRA Inc, Bill Neill with Riparian Repairs, Lillian Doherty, Eric Nguyen, Kelly Howard, and Chris Solek from USACE, and Jim Hartman from Los Angeles County Department of Agricultural Commissioner. Application of approved herbicides (e.g., imazapyr and glyphosate) and associated adjuvants (materials such as surfactants, dyes, and oils that aid in the application of herbicides), whether on standing Arundo, cut Arundo stumps, or regrowth after cutting, was unanimously considered the most effective method for treating Arundo under the kinds of conditions in the ULAR. The labor involved with cutting and removal of Arundo stems, whether prior to or following herbicide treatment, can potentially be the most expensive component of Arundo treatment. Cutting Arundo stems prior to herbicide treatment (also referred to as biomass removal) can be accomplished using mechanical (e.g., mowing and/or mulching) and/or hand techniques, with hand methods being much more time consuming and therefore potentially expensive. See Figure 2-1 showing mowing activities in Little Tujunga Wash. Furthermore, Arundo treatment projects may be required to remove or dispose of cut or dead Arundo stems from the river or floodplain after herbicide treatments to reduce the perceived risk of fire and/or flooding to adjacent lands and infrastructure and the potential downstream transportation of Arundo propagules (Stillwater Sciences 2011). Depending on the disposal method, for example whether stems can be mulched on site or must be disposed of at a landfill, this can greatly increase the labor and therefore potential cost of Arundo treatment projects and could make many projects financially unfeasible.

The most common methods for Arundo treatment in southern California, and their associated costs, are summarized below and in Table 2-1. Appendix A lists the various cost estimates gathered, considered, and used to develop the estimates provided in Table 2-1. A more detailed description of each approach follows below Table 2-1. The costs in Table 2-1 are applied to the acres of Arundo within the ULAR project area to develop total cost estimates for treating Arundo in Section 4.

Table 2-1. Arundo treatment cost/acre ranges.

Treatment type	Description	Cost/acre range*	Notes
Contingency/ Maintenance/ Retreatment	Herbicide application on scoured, burned, or previously treated regrowth	$1,000–2,000	This includes annual retreatment for all treatment types.
Spray only/bend-and-spray	Foliar herbicide application on standing biomass (i.e., no biomass removal)	$3,000–6,000	Biomass density and protection of native plants increases cost relative to Contingency-level treatment; also more herbicide and labor hours are necessary. Spray only is captured by lower end of cost range, while bend-and-spray is captured by higher end of cost range. This report combines these two treatment types into "spray only".
Cut-and-daub/cut-and-spray	Herbicide application on cut stumps or regrowth; biomass left on site	$4,000–9,000	Cost depends on biomass removal method (e.g., mechanical, by hand, or a combination). This report refers to these methods as "mechanical", "hand", or "mixed".
Cut-and-spray with disposal	Herbicide application on cut stumps or regrowth; biomass removed from site	$7,000–150,000	Cost depends on biomass removal method (e.g., mechanical, by hand, or a combination). Stem removal is estimated to cost an additional $3,000/acre, if a flail mower is used, to $150,000/acre if hand crews are used to mulch stems (Neill 2010). This report refers to these methods as "mechanical", "hand", or "mixed".

* Cost estimates based on treatment of 50-acre site, with gentle gradients, and available site access.
(Source: Stillwater Sciences 2011)

- **Contingency.** This method is a variation on spray only. Herbicide is sprayed onto the regrowth of Arundo that has recently been scoured by floods or burned by fire. Under these conditions, much of the Arundo biomass and surrounding vegetation has been removed, which facilitates access, reduces the amount of regrowth that must be sprayed, and is the cheapest treatment method to implement (Table 2-1).
- **Maintenance/retreatment.** Arundo treatment projects should plan for approximately five years of follow-up treatments or maintenance to ensure that all Arundo biomass is killed (Giessow 2010, Neill 2010). Since retreatment is done on previously cut and/or treated Arundo, it generally consists solely of herbicide application and is relatively cost effective to conduct (Table 2-1).
- **Spray only.** This method has been shown to be effective in southern California areas where leaving dying and dead Arundo stems is appropriate (e.g., in areas with low Arundo cover and/or where dead material will not increase fire risks) (Giessow 2010, Neill 2010). Approved herbicides are sprayed directly onto standing Arundo stems, either via backpack sprayers or vehicle-mounted spray tanks (Katagi et al. 2002). Because this method does not involve biomass removal it is one of the more cost-effective and straightforward methods to implement (Table 2-1).
- **Bend-and-spray.** This method requires minimal crews and equipment and minimizes the risk of herbicide application to non-target vegetation. As such, it is one of the most suitable

methods for remotely located, small to moderately sized infestations, with interspersed native vegetation (Newhouser 2008, Coffman and Ambrose 2011). The bend-and-spray method involves at least one worker bending Arundo stems away from native vegetation and an herbicide applicator spraying the bent stems with an approved herbicide (Coffman and Ambrose 2011). The hook-and-spray method is a variation of this method that involves only one applicator, who hooks and bends Arundo stems with one hand and sprays the bent stems with herbicide with the other hand (Coffman and Ambrose 2011). If dead Arundo stems treated with these methods can be left in place, these methods are similar in cost to spray only, although slightly more expensive due to the increase in labor hours (to bend or hook the stems) (Table 2-1). If dead Arundo stems must be mulched or removed, then the cost is significantly higher (Table 2-1).

- **Cut-and-daub/cut-and-spray.** Depending on the method with which Arundo stems are cut, this method can be appropriate in a wide variety of conditions. Both methods include cutting Arundo stems at or near the ground surface. Using cut-and-daub, cut Arundo stumps are immediately painted with an herbicide (Coffman and Ambrose 2011). Using cut-and-spray, cut stems are allowed to regrow for a season or two and then sprayed with herbicide. In dense Arundo infestations that can be accessed by vehicles, Arundo stems can be cut with modified mowers and/or mulchers. In less dense infestations or where access is constrained, Arundo stems can be cut with a chainsaw or hand tools. Because cut Arundo stems can sprout into new Arundo plants, it is important that cut stems not be allowed to fall in or near waterways (Coffman and Ambrose 2011). As with bend-and-spray methods, the cost of this method is significantly less if cut Arundo stems can be left in place rather than mulched or removed (Table 2-1).

The timing of these methods is critical to their success, but is constrained by Arundo life history (i.e., when it is growing and would most effectively translocate herbicide into the root system), seasonal climate conditions (when herbicides can be safely and effectively applied), and the bird nesting season (March to September). Late summer through early fall (August to October) is frequently when herbicides are applied to standing Arundo stems, or to stems that have been cut the previous winter. This timing avoids the bird nesting season and can maximize the efficacy of glyphosate herbicide, but can also allow for significant Arundo regrowth (in which case access is constrained and more herbicide is necessary). Herbicide application to standing or previously cut Arundo stems in spring or early summer, when Arundo is actively growing, can maximize the translocation of herbicide, particularly imazapyr, into the root system (and more quickly kill the plant) and reduces the potential for significant Arundo regrowth, but must be monitored and managed carefully to avoid nesting birds. All methods will most certainly require annual maintenance for several years to ensure that treated Arundo is killed. The contingency method is likely to be most appropriate in the summer following a flood or fire, and should not interfere with bird nesting, since the flood or fire will have presumably removed any potential bird nesting habitat in the immediate vicinity.

Small stands of Arundo, or areas of Arundo infestation in which herbicide application is not possible, may be treated by mechanical means as described in Ditomaso et al. (2013). Small plants (less than 6') can effectively be removed through pulling by hand or with small tools after a recent rain has loosened the soil. Larger stands may be eradicated by repeatedly chopping, cutting, or mowing shoots until the Arundo has exhausted its underground nutrient storage. Timing of removal should coincide with flowering, as underground nutrient storage is depleted during this time. In order to complete eradication, the entirety of the rhizome mass must be removed to avoid repeated infestation.

Figure 2-1. Arundo mowing in Little Tujunga Wash, courtesy of Bill Neill (Appendix C).

3 ARUNDO ERADICATION REGULATORY APPROACH

A programmatic regulatory approach for the Arundo Eradication Program is described in this section. The sources for this regulatory approach include relevant CEQA, NEPA, and permitting documentation in the project area.

Table 3-1 summarizes the permits, regulating agencies, and triggers that are most relevant to Arundo treatment projects in the ULAR, given the location, likely methods, and incorporated conservation measures. Much more exhaustive descriptions of these and other potential permit requirements are available from Katagi et al. (2002).

Table 3-1. Potential permit requirements for Arundo treatment projects.

Regulation	Regulating agency	Trigger for permit	Likely permit type
Clean Water Act Section 404	USACE	Working in floodway and building roads, placing thick mulch, etc., into floodway	Regional General Permit 41
Endangered Species Act Section 7 or 10	USFWS and/or NOAA Fisheries	Working near federally endangered or threatened species or their critical habitat	No-take-concurrence letter, Biological Opinion, or Safe Harbor Agreement
California Fish and Game Code Section 1600	CDFW	Working in floodway and riparian zone	Streambed Alteration Agreement

3.1 Clean Water Act Section 404 Regional General Permit

Under Section 404 of the Federal Clean Water Act (CWA), the U.S. Army Corps of Engineers (USACE) has jurisdiction over the area between any levees on the Los Angeles River and the cross-sectional extent of high-flow debris lines, as well as any adjacent wetlands that meet USACE criteria. Projects within this jurisdiction that require the excavation of stumps, building

of roads, and potentially the placement of thick mulch in this area would require a Section 404 permit. Many Arundo treatment projects in the ULAR are to include actions or be conducted in area that are under the USACE's jurisdiction and, therefore, will require a Section 404 permit. Those that are determined to be under the USACE's jurisdiction (e.g., when mulch is left in place) should qualify for a Section 404 Regional General Permit (RGP) 41, which covers weed removal in areas with densities greater than 50%. RGP 41 includes CWA Section 401 certification from the Regional Water Quality Control Board, but will trigger the need for Section 7 consultation with U.S. Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Service (NOAA Fisheries).-A Section 404 RGP can take a few months to complete and acquire.

3.2 Endangered Species Act Consultation

Whether or not a Section 404 permit is required, federal Endangered Species Act (ESA) consultation (under either Section 7 or 10) with USFWS and/or NMFS is likely to be required given the presence of federally listed species in and around the ULAR Arundo removal areas. For most treatment projects in the ULAR, No Take Concurrence from USFWS and/or NMFS should suffice, so long as projects incorporate take avoidance measures and are not so large that listed bird species may need to nest elsewhere. No Take Concurrence typically takes approximately 30 days. If these conditions do not apply, then a Biological Opinion (if a Section 404 permit is required) or a Safe Harbor Agreement (if a Section 404 permit is not required) may be necessary. These processes can take several months to a year.

For a list of species potentially impacted during this project and to be considered in an ESA consultation, see Table 4-5. Consultation with USFWS and NMFS (and CDFW for completeness) prior to completion of permit applications is recommended.

3.3 Fish and Game Code Section 1600 Streambed Alteration Agreement

All Arundo treatment projects in the ULAR will likely require a Section 1600 Streambed Alteration Agreement from the California Department of Fish and Wildlife (CDFW). Consultation with CDFW prior to preparation of a 1600 permit application is recommended to facilitate accurate application reporting and documentation. Section 1600 permit requirements would likely include the following:

- Pre-project surveys for special-status species must be done three weeks before start of project;
- All project field staff must attend environmental training sessions(s);
- A biological monitor must be on-site during all treatment work; and
- Development and implementation of mitigation and/or restoration plans may be required.

3.4 California Environmental Quality Act and National Environmental Policy Act

The California Environmental Quality Act (CEQA) requires a lead agency to identify a proposed project (provide a CEQA-level project description), to evaluate potential environmental impacts, and to mitigate those potential environmental impacts. Since LACDPW, USACE, and ANF have already complied with CEQA and/or NEPA for active arundo projects in the ULAR, this discussion focuses on the remaining 16 acres, not covered by these agencies. The 16-acre

Arundo eradication will likely require a Negative Declaration or Mitigated Negative Declaration under CEQA. The CEQA Lead Agency has not been determined at this time. Once a lead agency has been identified and a CEQA-level project description has been completed, timing for completion of a Negative Declaration is approximately three months while a Mitigated Negative Declaration typically takes approximately six months.

The National Environmental Policy Act (NEPA) would be triggered if federal funding is used as part of the project. Since the 16 acres of Arundo are not on federal lands or currently funded through federal programs, it is expected that compliance with NEPA will not be required. Arundo removal on federal lands are already covered by existing NEPA documentation through USACE and USFS.

4 ARUNDO TREATMENT AND PRIORITIES

This section describes Arundo treatment activities in the headwaters and key areas throughout the project area starting in the headwaters of the ULAR watershed and working downstream to the LAR mainstem and tributaries. Refer to Figure 4-1 and Sections 4.1 and 4.2 for more detail. A top-down watershed approach to Arundo treatment is more effective than scattered treatment since Arundo spreads by root mass and can quickly spread to downstream areas.

Opportunities to collaborate with federal, state, local agencies, and non-governmental organizations (NGOs) have already begun in the ULAR watershed. These collaborations are key to the success of this Strategic Plan due to the pervasive nature of Arundo, long-term management and monitoring needs to eradicate the invasive non-native species, and funding required to implement the Strategic Plan. Significant restoration programs and projects are underway in the ULAR and adjacent watershed areas. In order to maximize funding and successful implementation of this Strategic Plan, agencies and NGOs will need to continue to work together to identify multiple benefit opportunities to coordinate and collaborate to meet program and project goals. This existing programs and opportunities for collaboration are detailed in Sections 4.2 and 4.3.

Biodiversity and recovery of special status species is key to attainment of restoration goals in the ULAR watershed. In Section 4.4, special status species known to historically or currently exist within the ULAR watershed are detailed. Recovery actions, recommendations, and planning-related measures to provide habitat linkages to ULAR watershed Arundo removal areas are also included.

Finally, a prioritization matrix that includes prioritization criteria and ranking detail is included in Section 4.4 to set the stage for ranking subwatersheds within the ULAR watershed for removal and management activities. Refer to Table 4-6.

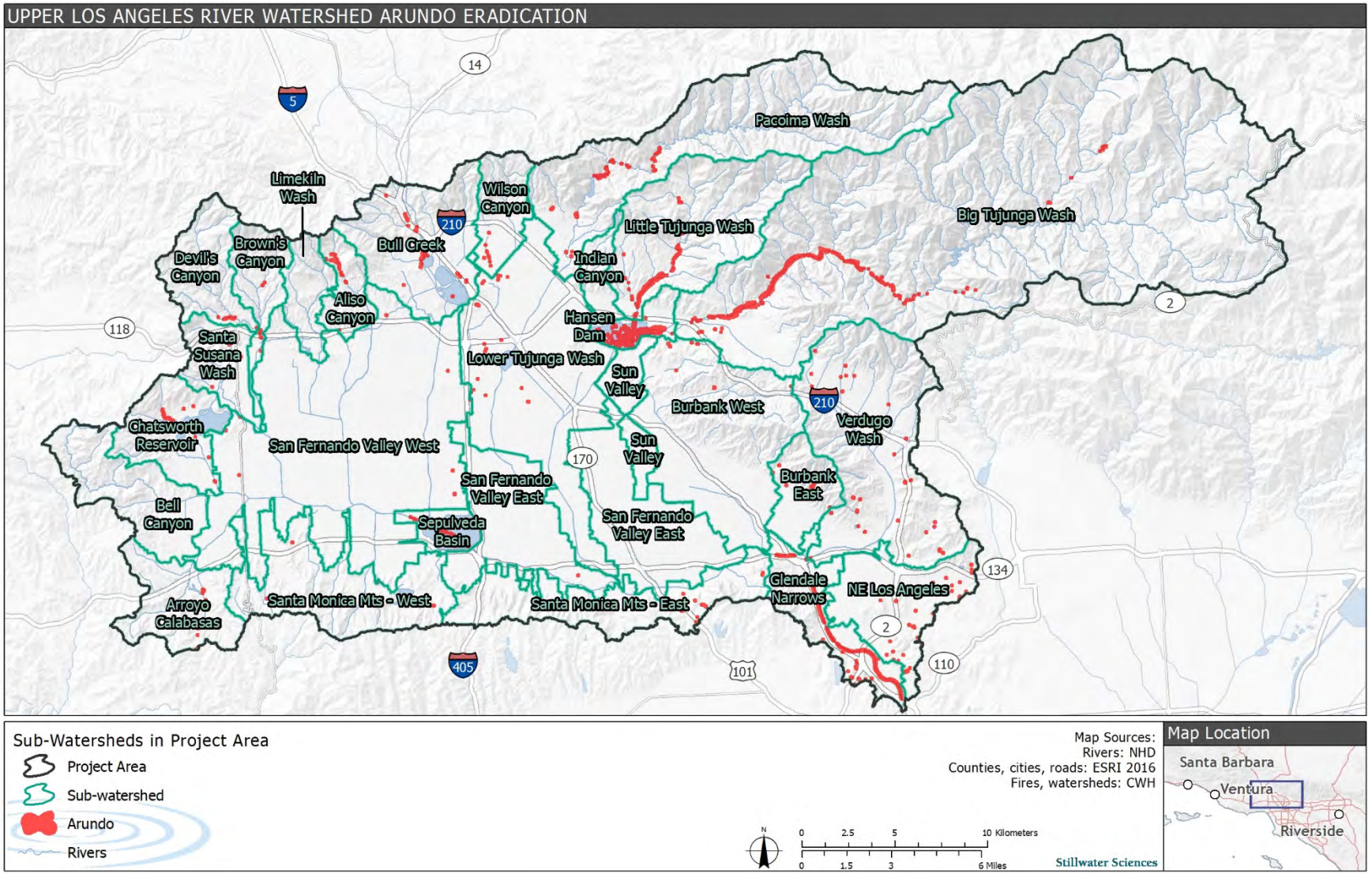

Figure 4-1. Upper Los Angeles River Watershed sub-watershed areas.

4.1 Outreach and Ownership for ULAR Arundo Treatment Areas

Mapping efforts of Arundo stands within ULAR, completed by CWH, provide critical ownership information that will guide right-of-entry (ROE) efforts. A summary of property ownership within the project area is found in Table 4-1. There are approximately 16 acres of Arundo on privately owned property in which ROE agreements will need to be secured in order for removal to occur. Contact information for property owners will be gathered using Los Angeles County records. Initial contact with property owners will be made via telephone, at which point the project, its importance, and impact on the owner's property will be discussed. Property owners will next be contacted with an email, for those in which such contact information is available. If phone call and email contact attempts are unsuccessful, then attempts to contact the property owners through an in-person visit will be made. All property owners will also receive a mailing which will include a summary of the project, including a map of the areas identified with Arundo, letters of support of agencies such as United States Forest Service and others, and a right-of-entry agreement that can be returned to Council for Watershed Health in a pre-stamped and labeled envelope. For instances when property owners are not responsive to the emails, phone calls, visits, or letters, additional phone calls and site visits will be made as necessary.

Table 4-1. Summary of properties within project area with known Arundo stands.

	Owner type	Owner	Arundo population count	Acres
Untreated Public: 35.08 ac Private: 15.96 ac	Public	USACE/LACFCD	270	21.76
	Public	City of Los Angeles DWP	110	6.67
	Public	City of Glendale	53	2.59
	Public	USFS	59	2.22
	Public	Caltrans	12	0.44
	Public	MTA	10	0.36
	Public	LACFCD	13	0.29
	Public	City of Los Angeles	15	0.28
	Public	County of Los Angeles	7	0.27
	Public	So Cal Edison Co.	1	0.10
	Public	LAUSD	2	0.06
	Public	State of California	4	0.04
	Public	MRCA	2	0.03
	Public	MWD	6	0.02
	Public	City of Calabasas	1	0.2
	Private	496 property owners (under 0.25 acres)	673	9.21
	Private	Pacific Ltg Service Co	37	1.80
	Private	Har Sylmar LLC	10	1.14
	Private	Motion Picture	8	0.64
	Private	Grigsby, Richard and Sharon	3	1.10
	Private	Evans, Charles B and Rose M TRS	11	0.56
	Private	Koland LLC	3	0.45
	Private	EQR Fresca 2009 Ltd	15	0.40
	Private	Nezad, Ray	3	0.39
	Private	Carp, Rita TR et al	2	0.27
Under Treatment 29.25 ac	Public	USACE/LACFCD	98	24.80
	Public	City of Los Angeles DWP	21	3.77
	Public	City of Los Angeles	1	0.07
	Public	Private Landowners	11	0.61

In addition to the methods listed above, this project will also include a wider range social media outreach campaign to reach both property owners as well as other residents in the areas identified for Arundo removal. The use of sponsored posts on Facebook, Twitter, and Instagram is a cost-effective method for reaching residents in areas in which Arundo removal is taking place, and can be used to garner overall community support and direct residents to educational materials on Arundo and its negative effects on water availability and habitat quality. See Figure 4-2 as an example social media post. Sponsored posts on these sites have the capacity to be hyper-local, reaching only users in specific geographic areas. This hyper-local aspect will aid in the efforts to reach property owners who may be unresponsive to other contact methods. Additionally, updates

on Arundo removal efforts as the project progresses will function to keep residents and supporters involved in the project's goals of full eradication of Arundo from the ULAR.

Figure 4-2. Sample social media post for project outreach campaign (Stillwater Sciences 2018).

4.2 Current Arundo Treatment Program Overviews

4.2.1 Tujunga Watershed

In 2013 the National Forest Foundation (NFF) in collaboration with United States Forest Service (USFS) initiated an ecosystem recovery program throughout the Upper Tujunga Watershed in response to the 2009 Station Fire. This program focuses on riparian areas that were likely to become degraded through the rapid spread of Arundo and other invasive species that degrade the habitat quality for threatened or endangered native fish, birds, plants, and other species. The majority of restoration activities are taking place on USFS lands, though to insure complete

eradication, all areas within the Upper Tujunga Watershed are included in the Big Tujunga Canyon Restoration Project. This includes lands owned by USACE, LA County Parks, private property, and private in-holdings within USFS lands, as shown in Figure 1 from Final Initial Study/Mitigated Negative Declaration, Big Tujunga Canyon Restoration Project (July 2014). Refer to Figure 4-3 Tujunga Watershed.

Figure 4-3. Tujunga watershed (Final Initial Study/Mitigated Negative Declaration, Big Tujunga Canyon Restoration Project, July 2014)

The Big Tujunga Canyon Restoration Project included four main tasks (Final Initial Study/Mitigated Negative Declaration, Big Tujunga Canyon Restoration Project, July 2014):

1. Riparian Restoration – Removal of non-native invasive plants (manually and/or with herbicide application); planting native trees and shrubs; maintenance; and monitoring treatment effectiveness.

2. Aquatic Restoration – Removal of small instream recreational dams constructed by visitors throughout the year. Implementation of this task will restore natural stream flow and allow special status fish species to travel, unimpeded, up- and downstream.
3. Chaparral Restoration – Leading restoration experts will design and test chaparral restoration methodologies on two test plots; the first, smaller plot (five acres) will inform the design of the second, larger plot (30 acres). Results are expected to have wide-ranging applications for chaparral restoration throughout southern California.
4. Ecologically Sustainable Recreation – This task involves reconstructing three highly-used picnic sites that were damaged/destroyed in the fire and rerouting a trail to protect the endangered arroyo toad. Visitor use at the picnic sites is exceeding carrying capacity and damaging sensitive resources in the nearby creek. Part of this task includes a public education component to assist recreational visitors in being aware of activities that can degrade resources and how to be better resource stewards.

Riparian restoration tasks include "removal of non-native invasive plants; planting native trees and shrubs; maintenance; and monitoring treatment effectiveness. Removal of non-native plants will include hand cutting using chainsaws or loppers and chipping of the cut biomass. Typically, chainsaws will be used to cut stems prior to herbicide treatment (cut and paint method), but cutting may also may be used to remove dead canes that were previously treated with herbicide" (Addendum CEQA Initial Study/Mitigated Negative Declaration Big Tujunga Canyon Restoration Project, July 2014).

This project is partially funded by the California State Wildlife Conservation Board, which required the completion of a CEQA document. NFF worked with Antelope Valley Resource Conservation District as the lead agency for CEQA. An initial mitigated negative declaration was submitted, which was then appended to include activities outside of USFS lands, as mentioned above.

For work occurring within USFS lands, USFS is the lead federal agency for compliance with NEPA. USFS prepared several NEPA documents for the various restoration activities, summarized below in Table 4-2 from Final Initial Study/Mitigated Negative Declaration, Big Tujunga Canyon Restoration Project (July 2014). USFS completed an environmental assessment to amend the programmatic biological opinion with regard to the use of herbicides for invasive species removal within USFS lands to allow for herbicide removal and compliance with NEPA.

Table 4-2. Status of USFS NEPA documentation.

Task	NEPA Document/Other	Date NEPA Completed	Date NEPA Expected
1. Riparian Restoration			
Weed removal, manual	CE/Decision Memo	July 2012	
Weed removal, herbicide	Environmental Assessment		October 2014
Planting shrubs/trees	CE-Wildlife Habitat/Decision Memo		October 2014
Maintenance and monitoring	CE-Wildlife Habitat/Decision Memo		October 2014
2. Aquatic Restoration			
Recreation dam removal	Biological Assessment/CE	July 2012	
3. Chaparral Restoration			
Pilot project	CE-Research/Decision Memo		October 2014
Scaling up 30-acre project	CE-Research/Decision Memo		October 2014
4. Sustainable Recreation			
Restore picnic areas	CE/No Project File		October 2014
Reroute trail	CE/Decision Memo		December 2014

The activities of this project also required additional permitting as summarized in Table 4-3 from Final Initial Study/Mitigated Negative Declaration, Big Tujunga Canyon Restoration Project (July 2014). In addition to the Section 404 permit from USACE, NFF acquired a Regional General Permit (RGP) for work in Hansen Dam and other federally regulated areas. The acquisition of the RGP was instrumental in the process of NFF securing a letter of support from the California State Water Resources Control Board.

Table 4-3. Agencies with regulatory approval for the Project.

Agency	Approval Authority	Jurisdiction
USACE	Section 404, Clean Water Act Permit	Discharge of dredged or fill material into "waters of the US" including wetlands
USFWS	Section 7, Federal Endangered Species Act – Biological Opinion	Federally listed threatened and endangered species and critical habitat
RWQCB	Section 401, Clean Water Act Water Quality Certification	Certifies that issuance of 404 permit will not violate clean water standards
CDFW	Approval of CEQA document; California Endangered Species Permit (CESA); Section 1600, Streambed Alteration Agreement	Trust natural resources of the state; State list threatened, endangered, and species of concern; Changes to the bed, channel, or bank (including the outermost limit of riparian vegetation) of any river, stream, or lake and associated impacts to biological resources
USACE: U.S. Army Corps of Engineers; USFWS: U.S. Fish and Wildlife Service; RWQCB: Regional Water Quality Control Board; CDFW: California Department of Fish and Wildlife.		

The presence of several endangered or threatened species within invasive species removal areas resulted in strict timelines of activity in the USFWS Section 7 permit. Activities for invasive species treatment and removal cannot occur between March 1st and September 15th. In certain areas, limited backpack spraying can take place no closer than 30 feet from a stream. Due to these

restrictions, NFF required large work crews to complete as much removal as possible within the limited time frame.

Figure 4-4. Arundo growth in Upper Middle Ranch, Tujunga before treatment (left) and after treatment (right) courtesy of Jason Giessow (Appendix B).

The Right of Entry Agreements (ROE) for private properties within the project area not under jurisdiction of USFS or USACE were acquired by NFF. The ROE documents were acquired through regular and repeated phone calls and site visits. Edward Belden, the lead program manager for this project from NFF indicated that once one or two ROE permits were received from property owners in the area, other owners were more likely to also submit their ROE (personal communication, June 2018). Several owners requested revegetation of the cleared area, and only two owners had not signed the ROE as of June 2018.

NFF conducted limited public outreach of their own for this project. Instead, most outreach occurred through third party area stakeholders and corporate funding partners. This project included job training through the USACE, which was helpful in attracting corporate partners and positive press (Edward Belden personal communication, June 2018).

Initial treatment of Arundo began in 2015, which included removal and chipping of biomass, as well as herbicide treatment. As of June 2018, the initial treatment of 50 acres of Arundo above Hansen Dam has been completed. It is estimated that an additional 13 acres are still in need of initial treatment and it is expected for this treatment to occur in Fall 2018. Approximately 67 acres of Arundo will need additional treatments to insure complete eradication.

The initial treatment efforts have been quantified through transect surveys, resulting in an average decrease in Arundo coverage from 410 canes/10m^2 to 5.3 canes/10m^2 (See Appendix B). Additionally, in areas where Arundo has been removed, early successional native plants species are reestablishing within the cleared areas. The native riparian canopy also appears to be returning, providing habitat for endangered species in the area. Furthermore, the in-stream flow seems to be improving with more water being available, though this has not been quantified to date (Edward Belden personal communication, June 2018).

Looking forward, NFF is working to secure additional funding as the majority of grants received are expiring in three to five years. Evaluation of retreatment efforts is needed in order to see the complete eradication of Arundo from the Upper Tujunga.

Pacoima Subwatershed

A six-person crew from ACS Habitat Management was working within Pacoima subwatershed on June 14, 2018. Discussion with the crew's leader provided valuable information on the logistical aspects of Arundo removal.

The crew was treating Arundo using the bend-and-spray method with an herbicide diluted to 4oz per gallon. A small area of densely growing Arundo of approximately 30 feet by 80 feet takes 30 minutes to treat with a crew of six, while larger areas (100 feet by 200 feet) take approximately 90 minutes to treat. The crew is made aware prior to treatment of any native fish or sensitive plant species within the area. If native fish are present in the stream, no spraying takes place within 30 feet of the stream. Within 30-100 feet of the stream, tall stalks are bent or broken, and then sprayed with herbicide. At distances greater than 100 feet, the entire plant is sprayed without bending. In areas with sensitive plant species, Arundo stalks are bent away from the plant before spraying in order to avoid accidental herbicide treatment of the sensitive plant.

An operational team based in the office coordinates entry onto private properties with land owners in which right-of-entry agreements have been established for treatment of Arundo. Timing of access and specific locations to be treated are communicated to the crew. In some instances owners request specific stands of Arundo to be left in place for privacy, erosion control, shade, or aesthetic purposes.

The crew records on a GPS unit the locations of Arundo and whether treatment occurred or not. Treated locations are visited again after a year for potential retreatment needs. Retreatment must be thoroughly walked through, as new growth may be small and easy to miss. Areas recently burned by fires tend to be the easiest to treat, though the entire burn area that previously was infested with Arundo must be rigorous to avoid missing small regrowth. In dense Arundo stands in which homeless encampments exist, no spraying will take place within 50 feet of the homeless encampment. All overgrown areas are checked for potential homeless encampments before treatment begins. Only Arundo is treated, no other invasive species are sprayed by the crew unless specifically directed to do so.

4.2.2 Hansen Dam

Arundo removal in the Tujunga watershed includes the heavily infested area of Hansen Dam. The removal of Arundo from Hansen Dam has been spearheaded by Bill Neill of Riparian Repairs (Appendix C). Removal of Arundo from Hansen Dam was funded primarily by WCB, LADWP, and other grants through the NFF program. Work was done by Bill himself, at times working with crews from Los Angeles Conservation Corps.

Bill Neill spent roughly 370 hours treating 30 acres of Arundo in Hansen Dam from October 2016 to January 2018. Arundo removal was usually done by spraying Arundo stalks with Polaris diluted to a concentration of 4 ounces per gallon. When spraying retreatment areas, Arundo would be sprayed once it had developed several large green leaves in order to maximize the effect of treatment. The cost of herbicide for fourteen months of treatment was approximately $3,300. This cost does not include labor. Biomass of dead Arundo was left on site to decompose, which lowered the cost of treatment.

Mowing of large stands of Arundo took place in flat areas that were generally free of rocks. Using a mower did not require an amendment to the USCAE 404 permit, as this permit does not exclude mower operation. Mower operation was estimated at $130/hour by Oakridge Landscape based in San Fernando Valley. If mowing was not an option for large stands of Arundo, then narrow access trails would be established. Arundo spraying would take place along the access trails expanding outwards as new areas were exposed post-spraying.

The Creek Fire of December 2017 burned large portions of remaining Arundo stands within Hansen Dam and allowed access to previously inaccessible areas. Treatment post-fire was emphasized due to the lower effort level required treating recently burned areas (see Figure 4-5).

Figure 4-5. Post Creek Fire growth of Arundo in Hansen Dam, courtesy of Bill Neill.

4.2.3 USACE treatment areas

The USACE Operations Division staff, Lillian Doherty, Eric Nguyen, and Kelly Howard, recently met with CWH and Stillwater Sciences in June 2018 to discuss USACE treatment areas in the ULAR, including Sepulveda Basin and Glendale Narrows. Issues raised by USACE include massive quantities of trash associated with homeless encampment clean-up activities, local nurseries selling arundo as a landscaping option, neighboring landowners planting invasive plants along Glendale Narrows and Sepulveda Basin, and vector control spraying trees marked by USACE as "protected trees for nesting least Bell's vireo". More education and communication about Arundo and other invasive treatment is necessary to address these issues.

Sepulveda Basin Homeless Encampment Clean Up

The U.S. Army Corps of Engineers in partnership with LAPD HOPE Team, West Valley Division, LA City Park Rangers, and Los Angeles Homeless Services Authority have conducted trash and debris clean-ups along the south side of Burbank Boulevard just east of Balboa Boulevard in recent years. Efforts restored the land to its intended and full use by removing

remaining trash and other floatable debris as well as managing non-native vegetation that was used as cover for substantial homeless encampments. There were no impacts to traffic or natural resources. Communities in the area continue to applaud this collaborative effort.

Before and After Clean-up Site Photos (Source: USACE)

The Corps and the City of Los Angeles will continue working together to maintain a clean and safe environment for the recreating public within the Sepulveda Basin.

4.2.4 County of Los Angeles treatment areas

Jim Hartman, Los Angeles County Department of Agricultural Commissioner (LACDAC) provided valuable insight to invasive species removal projects for several county agencies. The LACDAC is the main agency within LA County responsible for invasive species removal work. Jim has worked on Arundo removal in San Francisquito Canyon within the Santa Clara River watershed as part of his role within LACDAC. This program is mainly funded by $7.6 million in fire cost settlement funds that was awarded as part of a lawsuit against CB&I Constructors Inc., the company that was found liable for the Copper Fire in a 2012 court ruling. As this project was within USFS owned land, USFS completed required NEPA documentation for invasive weed treatment that included treatment of Arundo, tamarisk (*Tamarix* ssp.), and fountain grass(*Pennisetum setaceum*). Requirements in this NEPA document included restrictions on

herbicide treatment: aquatically registered materials must be used. The USFS reached out to LACDAC for collaboration, which facilitated entry onto land owned by Los Angeles Department of Water and Power within the project area. The LACDAC has been collaborating on this project for approximately 2.5 years.

Jim noted that for invasive species removal being done within Glendale Narrows and Sepulveda Basin, use of glyphosate has been limited due to community concerns. Invasive species treatment within the Los Angeles River is permitted, however Jim advised a written recommendation from licensed Pesticide Control Advisor (PCA) would be needed. This license, if needed for the ULAR Arundo Eradication Program, could be secured through the LACDAC with assistance from the Agricultural Commissioner's Office.

Other Arundo removal projects in the greater Los Angeles include the East Fork Camp along the San Gabriel River. Miller-Coors awarded $100,000 in funds to National Resources Conservation Service for Arundo removal. California Conservation Corps is completing Arundo removal in the Santa Clara River near Santa Clarita.

4.3 Opportunities to Collaborate on ULAR Watershed Arundo Treatment

There are several overlapping ecosystem restoration or related projects occurring within the proposed ULAR Arundo eradication project area. These projects provide vital opportunities for collaboration to achieve complete Arundo eradication within the ULAR watershed. The largest proposed project is the USACE Los Angeles River Ecosystem Restoration project which includes 11 miles of the Los Angeles River from Glendale Narrows to the southwest downtown reach at First Street (see Figure 4-6). The City of Los Angeles has decided to move forward with alternative 20, which would restore 719 acres within the project area (USACE 2015).

Due to the City of Los Angeles residing within a biodiversity hotspot of rare chaparral biome, a biome which covers only 2% of Earth's surface yet is home to 20% of its plants species, the City of Los Angeles passed a Biodiversity Motion in 2017. This motion includes objectives to "develop policies and projects to enhance biodiversity, including improving access for communities that lack access and contributing toward broader ecosystem functions and sustainability" (LA Sanitation 2018). The initial steps to implement this motion included the evaluation of the state of biodiversity within Los Angeles using the Singapore Biodiversity Index. The published findings from this report emphasize the importance of "riparian areas that are still interconnected, soft-bottomed, and directly influenced by key natural processes including flooding that support self-germination and resist exotic invasive species" (LA Sanitation 2018). The Biodiversity initiative, in combination with the many species recovery plans which include critical habitats within the Los Angeles River watershed (see Appendix D for summary of affected species as listed in Table 4-5), provides an opportunity to collaborate with federal, state, and local agencies in order to achieve the project's goal of complete Arundo eradication within the ULAR. Additionally, the Greater Los Angeles County Integrated Regional Water Management Plan incorporates an Enhanced Watershed Management Plan for ULAR which includes multi-benefit projects that "enhance plant and bird habitat." Table 4-4 includes projects funded under the EWMP and IRWMP for ULAR that would provide opportunities for collaboration on Arundo removal and subsequent habitat restoration.

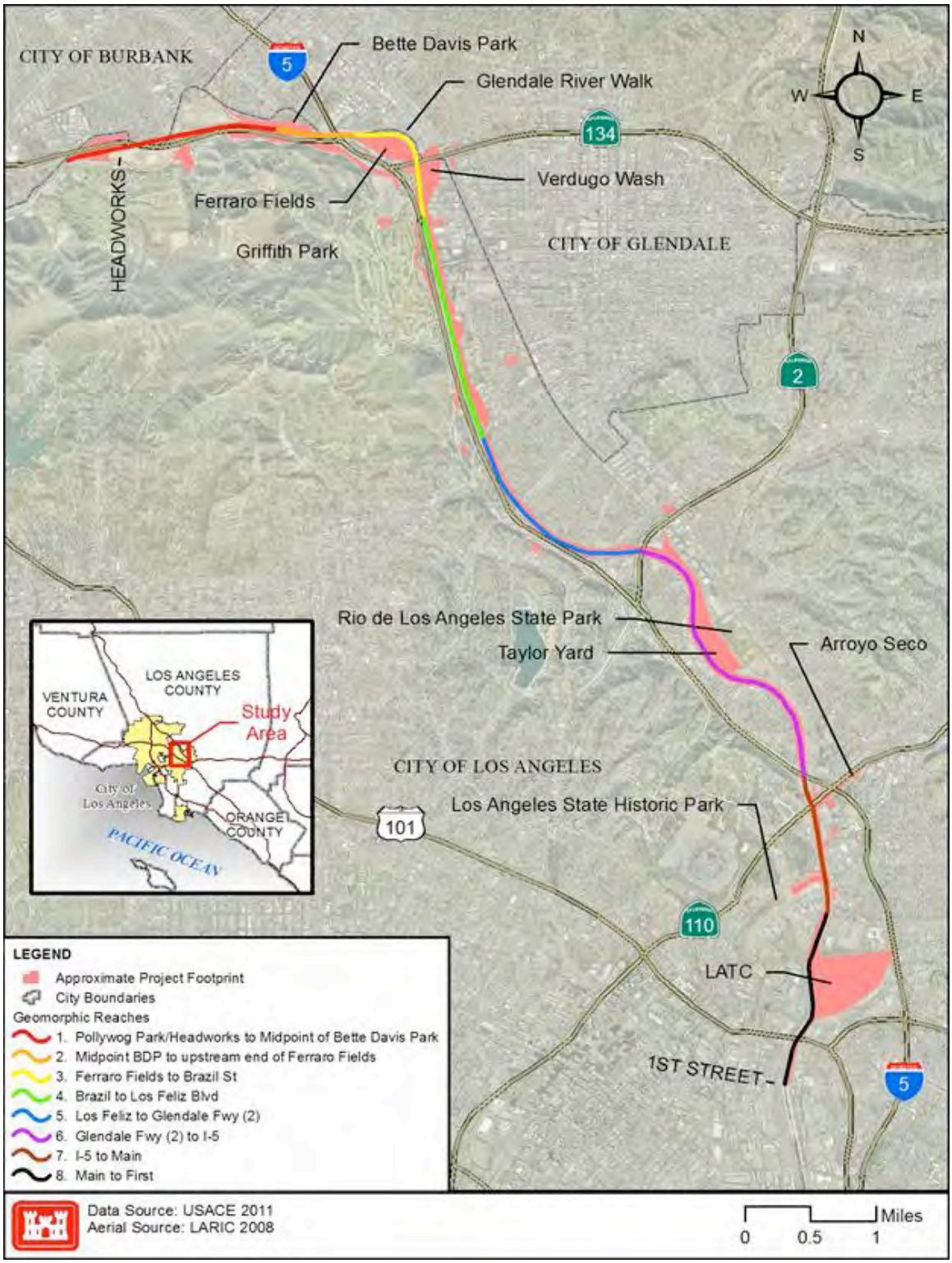

Figure 4-6. USACE Los Angeles River ecosystem restoration areas (from Final Integrated Feasibility Report).

Table 4-4. Overlapping projects with potential Arundo removal within project area.

Project name	Location	Agency
Sepulveda Dam Basin Vegetation Management	Sepulveda Dam	USACE
Pacoima Spreading Grounds Improvement Project	Pacoima	LACFCD & LADWP
Mullholland Scenic Corridor Project	Rim of the Valley Trail along Mulholland Drive	MRCA
Project Planning and Design—Pacoima Wash to Angeles National Forest	Pacoima	MRCA
Project Planning and Design—Sage to Santa Susana Pass	Sage Ranch to Santa Susana Pass State Historic Park	MRCA

4.4 Arundo treatment priorities

The Strategic Plan described a number of general criteria used to prioritize Arundo treatment projects within sub-watersheds of the project area (Figure 4-1). Criteria for Arundo treatment projects include:

- Remove Arundo under mature riparian forests, especially adjacent to fire-prone shrublands;
- Remove the largest Arundo propagule sources;
- Control Arundo on a watershed scale; and
- Remove Arundo immediately after fires or floods.

While these general Arundo treatment prioritization criteria are useful, additional criteria were necessary to prioritize Arundo treatment efforts on specific ULAR watershed parcel areas**.** Responses to these questions were used to rank treatment priorities as high, medium, or low.

- Main property owners – Is the infested parcel under public ownership (LA County, USACE, City of Los Angeles, USFS, LACFCD) or private ownership?
- Active plans to remove Arundo – Are there existing projects within the parcel to remove Arundo? If so, what is the project(s) extent?
- Level of existing Arundo removal efforts – If projects to remove Arundo exist within the parcel, is the project's priority Arundo removal, or is this a side benefit of the project?
- Recent fire in parcel area – Has the area recently burned, potentially making it at risk for Arundo infestation?
- Current actions to remove Arundo from recently burned areas– Are there any steps being taken in the parcel area to prevent infestation of Arundo in recently burned areas?
- Sensitive species – What sensitive aquatic, wildlife, and plant species are within the parcel area?
- Existing riparian corridor – What is the quality of existing riparian habitat in the parcel?

- Public attitude – Is the surrounding community generally supportive of Arundo removal and watershed restoration projects?
- Funding – What is the funding potential for Arundo removal within the parcel?
- Likelihood of success story – What is the likelihood that Arundo removal in parcel would result in a success story that would be helpful in securing additional funding?

Special status species summaries are provided in Appendix D and listed in Table 4-5.

A draft prioritization matrix is provided in Table 4-6. This matrix is a work-in-progress evaluation of 27 subwatersheds within the ULAR watershed. Input from the ULAR Arundo Eradication Team is necessary to truth-check scores (high, medium, low) and other detailed subwatershed data before prioritization results are solidified in the Strategic Plan.

The Council for Watershed Health has developed a cost table for implementation of the Strategic Plan. Refer to Table 4-7.

Table 4-5. Threatened or endangered species potentially impacted by Arundo removal.

Scientific name	Common name
Polioptila californica	coastal California gnatcatcher
Anaxyrus californicus	arroyo toad
Rana muscosa	southern mountain yellow-legged frog
Vireo bellii pusillus	least Bell's vireo
Empidonax traillii extimus	southwestern willow flycatcher
Coccyzus americanus occidentalis	western yellow-billed cuckoo
Lampetra richardsoni	Western brook lamprey
Oncorhynchus mykiss	Southern California steelhead
Catostomus santaanae	Santa Ana sucker
Rhinichthys osculus subspecies	Santa Ana speckled dace
Gasterosteus aculeatus williamsoni	unarmored threespine stickleback
Gasterosteus aculeatus microcephalus	inland threespine stickleback
Oncorhynchus mykiss irideus	coastal rainbow trout
Gila orcutti	arroyo chub
Berberis nevinii	Nevin's barberry
Centromadia parryi ssp. *australis*	southern tarplant
Chorizanthe parryi var. *fernandina*	San Fernando Valley spineflower
Dodecahema leptoceras	slender-horned spineflower
Symphyotrichum greatae	Greata's aster
Sidalcea neomexicana	salt spring checkerbloom
Ribes divaricatum var. *parishii*	Parish's gooseberry
Orcuttia californica	California orcutt grass
Monardella hypoleuca ssp. *hypoleuca*	white-veined monardella
Malacothamnus davidsonii	Davidson's bush-mallow
Lasthenia glabrata ssp. *coulteri*	Coulter's goldfields

Table 4-6. Prioritization criteria for Arundo removal in project area sub-watersheds.

Subwatershed area	ID	Watershed acreage	Fish	CNDDB plant	CNDDB wildlife	Mapped Arundo (values in acres)			Main property owner(s)? (County, Corps, City, USFS, private)	Are there active plans to remove Arundo	What is the level of existing Arundo removal effort?	What is status of ROE for area?	Is there a recent fire in area or contributing area?	What are current actions to nip Arundo in bud in burn area	What sensitive Aquatic Spp are in area	What sensitive Wildlife Spp are in area	What sensitive Plant Spp are in area	What is existing Quality of Riparian Corridor?	What is public attitude re Arundo removal and WS restoration?	Funding potential for area	Liklihood of high profile success story	Contingencies - e.g., is there an upstream subbasin that needs to have arundo removal done first? If so, which subbasin(s)?
						High	Medium	Low														
Aliso Canyon	1	2774.86	none	California Orcutt grass, slender mariposa-lily	none	2.05			City County	Yes?				ngo County City	gnatcatcher?			Medium		Medium	Medium	Check?
Arroyo Calabasas (Old Topanga)	2	6262.37	none	San Fernando Valley spineflower, Braunton's milk-vetch	none	1.83		0.01	Private	Yes	Check?		Yes	ngo County Fire	steelhead downstream				High	Medium	Medium	Yes
Bell Canyon	3	7609.18	none	Braunton's milk-vetch, Santa Susana tarplant, slender mariposa-lily	none			0.01														
Big Tujunga Wash	4	80167.06	arroyo chub & santa ana speckled dace	Nevin's barberry	none				ANF, private, County	Yes	High		Yes	ANF CWH NFF	SAS, chub, UTS			High				Yes
Brown's Canyon	5	3849.17	none	California Orcutt grass, Coulter's goldfields, San Fernando Valley spineflower, slender mariposa-lily	none	0.35																
Bull Creek	6	10546.99	none	California Orcutt grass, Davidson's bush-mallow, San Fernando Valley spineflower, slender mariposa-lily	coastal California gnatcatcher, least Bell's vireo	2.58		0.01														
Burbank East	7	3864.30	none	San Fernando Valley spineflower	none	1.50		0.06														
Burbank West	8	16764.79	none	Davidson's bush-mallow, mesa horkelia, Nevin's barberry, San Fernando Valley spineflower, slender mariposa-lily, slender-horned spineflower, white rabbit-tobacco	coastal California gnatcatcher, least Bell's vireo	0.20	0.17	0.30														

Subwatershed area	ID	Watershed acreage	Fish	CNDDB plant	CNDDB wildlife	Mapped Arundo (values in acres)			Main property owner(s)? (County, Corps, City, USFS, private)	Are there active plans to remove Arundo	What is the level of existing Arundo removal effort?	What is status of ROE for area?	Is there a recent fire in area or contributing area?	What are current actions to nip Arundo in bud in burn area	What sensitive Aquatic Spp are in area	What sensitive Wildlife Spp are in area	What sensitive Plant Spp are in area	What is existing Quality of Riparian Corridor?	What is public attitude re Arundo removal and WS restoration?	Funding potential for area	Liklihood of high profile success story	Contingencies - e.g., is there an upstream subbasin that needs to have arundo removal done first? If so, which subbasin(s)?
						High	Medium	Low														
Chatsworth Reservoir	9	6204.20	none	Braunton's milk-vetch, Coulter's goldfields, many-stemmed dudleya, Santa Susana tarplant, slender mariposa-lily	arroyo toad	2.74		0.13														
Devil's Canyon	10	5229.11	none	California Orcutt grass, Santa Susana tarplant, slender mariposa-lily	least Bell's vireo	0.94																
Glendale Narrows	11	5896.47	none	Greata's aster, mesa horkelia, Nevin's barberry, San Fernando Valley spineflower	least Bell's vireo, southwestern willow flycatcher	50.18	0.15	0.69	City County	Yes	Mixed success		No	Corp County City ngo	invasives					High	High	
Hansen Dam	12	2080.28	arroyo chub & santa ana speckled dace	none	none				ANF, private, County	Yes	High		Yes	ANF CWH NFF	SAS, chub, UTS			High				Yes
Indian Canyon	13	1826.17	arroyo chub & santa ana speckled dace	none	none				ANF, private, County	Yes	High		Yes	ANF CWH NFF	SAS, chub, UTS			High				Yes
Limekiln Wash	14	3082.66	none	California Orcutt grass	none																	
Little Tujunga Wash	15	13651.80	none	Davidson's bush-mallow	none				ANF, private, County	Yes	High		Yes	ANF CWH NFF	SAS, chub, UTS			High				Yes
Lower Tujunga Wash	16	20497.05	none	Davidson's bush-mallow, mesa horkelia, Nevin's barberry, San Fernando Valley spineflower, slender-horned spineflower	coastal California gnatcatcher, western yellow-billed cuckoo	0.15	0.03	0.51	ANF, private, County	Yes	High		Yes	ANF CWH NFF	SAS, chub, UTS			High				Yes
NE Los Angeles	17	8001.99	none	Greata's aster, mesa horkelia, Parish's gooseberry, southern tarplant	least Bell's vireo, southwestern willow flycatcher	0.10	0.06	1.36														
Pacoima Wash	18	22340.82	none	Davidson's bush-mallow, Greata's	southern mountain	4.73			ANF, private,	Yes	High		Yes	ANF CWH NFF				High				Yes

Subwatershed area	ID	Watershed acreage	Fish	CNDDB plant	CNDDB wildlife	Mapped Arundo (values in acres)			Main property owner(s)? (County, Corps, City, USFS, private)	Are there active plans to remove Arundo	What is the level of existing Arundo removal effort?	What is status of ROE for area?	Is there a recent fire in area or contributing area?	What are current actions to nip Arundo in bud in burn area	What sensitive Aquatic Spp are in area	What sensitive Wildlife Spp are in area	What sensitive Plant Spp are in area	What is existing Quality of Riparian Corridor?	What is public attitude re Arundo removal and WS restoration?	Funding potential for area	Likilihood of high profile success story	Contingencies - e.g., is there an upstream subbasin that needs to have arundo removal done first? If so, which subbasin(s)?
						High	Medium	Low														
				aster, San Gabriel linanthus, southern tarplant	yellow-legged frog, least Bell's vireo				County													
San Fernando Valley East	19	19605.76	none	San Fernando Valley spineflower, slender-horned spineflower	coastal California gnatcatcher, least Bell's vireo			0.09														
San Fernando Valley West	20	37033.91	none	San Fernando Valley spineflower, Coulter's goldfields	coastal California gnatcatcher, arroyo toad	0.15		0.23														
Santa Monica Mts - East	21	9330.02	none	Braunton's milk-vetch, mesa horkelia, slender mariposa-lily	least Bell's vireo	0.48	0.14	0.43														
Santa Monica Mts - West	22	10971.05	none	white-veined monardella, Braunton's milk-vetch	none	0.07		0.17														
Santa Susana Wash	23	3791.90	none	Coulter's goldfields, San Fernando Valley spineflower, Santa Susana tarplant, slender mariposa-lily	least Bell's vireo	0.04	0.05	0.04														
Sepulveda Basin	24	1965.09	none	none	least Bell's vireo	3.96			City County	Yes	Mixed success			Corps City ngo	LBV					High	High	
Sun Valley	25	2916.01	none	Davidson's bush-mallow, slender-horned spineflower	coastal California gnatcatcher																	
Verdugo Wash	26	19119.14	none	mesa horkelia, Parish's gooseberry, Parry's spineflower, Davidson's bush-mallow, salt spring checkerbloom, slender-horned spineflower, southern tarplant, white rabbit-tobacco	southwestern willow flycatcher, least Bell's vireo	1.94	0.23	0.71	County				Yes	County	cactus wren				Medium	High	Medium	No
Wilson Canyon	27	3836.67	none	none	none	0.39		0.07														

Table 4-7. ULAR project area Arundo eradication implementation budget estimates.

Task	Planning	Treatments										Total
		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	
1. Mapping												$0
2. Permitting/ ROE Agreements	$15,000					$25,000						$40,000
3. Burn Area Rapid Response												$0
4. Treatment		$475,000	$475,000	$240,000	$108,000	$98,000	$98,000	$45,000	$45,000	$45,000	$45,000	$1,674,000
5. Monitoring		$30,000	$30,000	$30,000	$30,000	$30,000	$40,000	$30,000	$40,000	$20,000	$20,000	$300,000
6. Management/ Reporting	$12,500	$34,000	$34,000	$27,500	$27,500	$17,000	$17,000	$17,000	$12,000	$12,000	$25,000	$235,500
Total	**$27,500**	**$539,000**	**$539,000**	**$297,500**	**$165,500**	**$170,000**	**$155,000**	**$92,000**	**$97,000**	**$77,000**	**$90,000**	**$2,249,500**

Source: Council for Watershed Health (2018)

5 ARUNDO TREATMENT AND POST-TREATMENT REVEGETATION MONITORING

Long-term monitoring of restoration sites and high-quality reference sites for both aquatic and riparian habitat is recommended in this Strategic Plan to track and report on Strategy progress, inform adaptive management of restoration areas, increase the understanding of the ULAR system response to Arundo, and to assist in developing effective restoration plans. In particular, monitoring of the effectiveness of different types of restoration and revegetation strategies relative to environmental conditions in the ULAR watershed (e.g., gaining versus losing reaches, time since last disturbance from flood or fire) will help guide and increase the success rate of future restoration efforts.

Overall, Arundo treatment and revegetation projects specified in this plan would make excellent restoration monitoring sites. These methods can be easily adapted to individual, select ULAR Arundo treatment projects to maximize the contribution of these projects to the collective understanding of the most effective Arundo treatment and revegetation methods for the ULAR and broader Southern California region, and associated costs.

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Appendices

Appendix A

Documented Arundo Treatment Project Costs

Description	Cost/acre	Notes	Source
Permits	$2,387	For Arundo removal and revegetation of an approx. 1-acre site on the beach in Santa Barbara County	Chang 2010
Glyphosate applied to hand-cut stumps	$25,765	Involved approximately 500 man-hours for an approx. 1-acre site in Santa Barbara County	Chang 2010
Biomass disposal	$2,318	21.3 tons of Arundo disposed of at Santa Barbara County landfill	Chang 2010
Retreatment	$1,442	Involved approximately 68 man-hours for an approx. 1-acre site in Santa Barbara County	Chang 2010
Low-volume application of imazapyr to small clumps without cutting	$1,000–1,500	Restricted to clumps smaller than 40 ft across, treated by applicators using backpack sprayers; assumes 12-hr labor @ $60/hr for initial treatment and 2-3 follow-up visits over 2 years plus $250 for 3 qt imazapyr herbicide and adjuvant	Neill 2006
High-volume application of glyphosate to large stands without cutting	$3,000–7,000	Suitable for Arundo stands as large as 1 acre, treated by 4-man crew using gasoline-powered pump, ladders and long hoses to apply 60–100 gln dilute glyphosate herbicide mixture; high end of price range includes labor to compact Arundo and trim native trees where intermixed	Neill 2006
Large flail mower for biomass reduction followed by resprout spraying	$4,000–6,000	Suitable for dense stands larger than 1 acre on relatively open, level terrain; assume $3000–5000/acre for biomass reduction by flail mower and $1000/acre for low volume foliar treatment of resprouts using imazapyr herbicide	Neill 2006
Small flail or rotary mower biomass reduction followed by resprout spraying	$7,000–10,000	Suitable for steep slopes and stands intermixed with trees; assume $6000–$9000/acre for biomass reduction by smaller flail or rotary mower and $1000/acre for low volume foliar treatment of resprouts using imazapyr herbicide	Neill 2006
Chainsaw crew with portable shredder for biomass reduction followed by resprout spraying	$20,000–150,000	Suitable for locations requiring biomass reduction but not accessible to mower tractors; price range depends on stand density, accessibility, amount of dead thatch, etc.	Neill 2006
Herbicide application (single treatment)	$850		Simmons and Berry, no date
Biomass removal and mulching	$3,116		Simmons and Berry, no date
Maintenance	$2,000	Cost per year	Simmons and Berry, no date
None provided	$9,333	Cost per acre for 1,500 acres on the Santa Ana River	Simmons and Berry, no date
None provided	$15,000	Cost per acre for 290 acres on the San Luis Rey	Simmons and Berry, no date
None provided	$1,000	Cost per acre for 1,000 acres on the Russian River	Simmons and Berry, no date
None provided	$34,000	Cost per acre for 0.25 acre on the Trabucho Creek	Simmons and Berry, no date
None provided	$20,000–80,000	Includes five-years of retreatments	Russell 2010

Appendix B

Monitoring Report for Tujunga Arundo Removal

Tujunga Watershed Arundo control program:

Transect and Photo Monitoring Report

June 2018

Field transect monitoring:

Twelve monitoring plots were established in May 2017 on Little Tujunga (4) and Big Tujunga (8) Watersheds (Appendix A). The plots monitor a 1m x 10m belt. The main focus of the monitoring plots is to track treatment efficacy, as Arundo control is the goal of the project. Arundo cane density is counted in the belt and cover is recorded. To help track long-term performance the cover of all species are also recorded in the 1m x 10m belt. A photo of the transect is also recorded at each monitoring visit (referred to as a base stake to end point photo, Appendix A). Plot data for all sampling years is presented in Appendix B. A large wildland fire occurred in December 2017. The fire burned most of Little Tujunga (including all plots) and portions on Big Tujunga (no monitoring plots were burned).

Treatment efficacy (effectiveness of treatments) was very good on most monitoring plots. The program is implementing effective Arundo control. Overall cover has dropped from 80% pre-control cover to 1.9% cover, shown in Table 1. Cane density shows the same drastic reduction in Arundo with 410 canes in 10m sq dropping to 5.3 canes after two years (Table 1). In the field, this looks like scattered re-sprouting canes. Six plots have had one initial treatment and one re-treatment and six plots have only had a single treatment. Plots with both an initial treatment and a re-treatment have only trace amounts of Arundo cover. All plots were cut first to remove biomass, and then re-sprouts were treated. Treatment details for each plot are presented in Appendix B.

Table 1. Average Arundo cover and cane density on the twelve monitoring plots.

Year	Treatments	Percent cover (average)	Cane density 10 sq m (average)	Notes:
2015	Before	80	410	Arundo data from coastal watershed report (2011)
2017	Most cut, untreated	52.7	199	Sampled May 2017
2018	All under treatment	1.9	5.3	Sampled June 2018

At this time, only a few years into the Arundo control program, most plots have very low plant cover dominated by annual plants that are growing in response to increased light availability (Table 2). Most species that were recorded on the transects would be considered to be early successional annual species, some of which are native (Ambrosia, Helianthus, Datura, Phacelia) and some of which are 'naturalized' non-native (Hirchfeldia, Chenopodium, Bromus, Conyza). Two non-native species were observed that should be suppressed, tree tobacco (on one transect) and castor bean (not on transects, but observed in work areas), as these species are aggressive and could form persistent and expanding populations. All other non-natives that were observed are part of the system, occurring in both disturbed and undisturbed areas (they are naturalized). Complete transect data is provided in Appendix B. Re-vegetation is not part of the project, and most projects that undertake Arundo control focus on

control of the Arundo and then allow natural succession to occur over time once the Arundo has been controlled/removed from the system. Most riparian systems in are functional, although modified, riparian vegetation recruitment and re-establishment processes. In southern California, riparian systems are naturally dynamic, with long periods of intermittent low rainfall/low energy events, punctuated by high flow/high energy events that 're-set' the riparian system. It is these periodic events that create conditions allowing native woody plant recruitment in the portions of the system that will support native woody plant cover. It is also important to remember that Arundo fills un-vegetated or 'open areas' as well as displacing other plants.

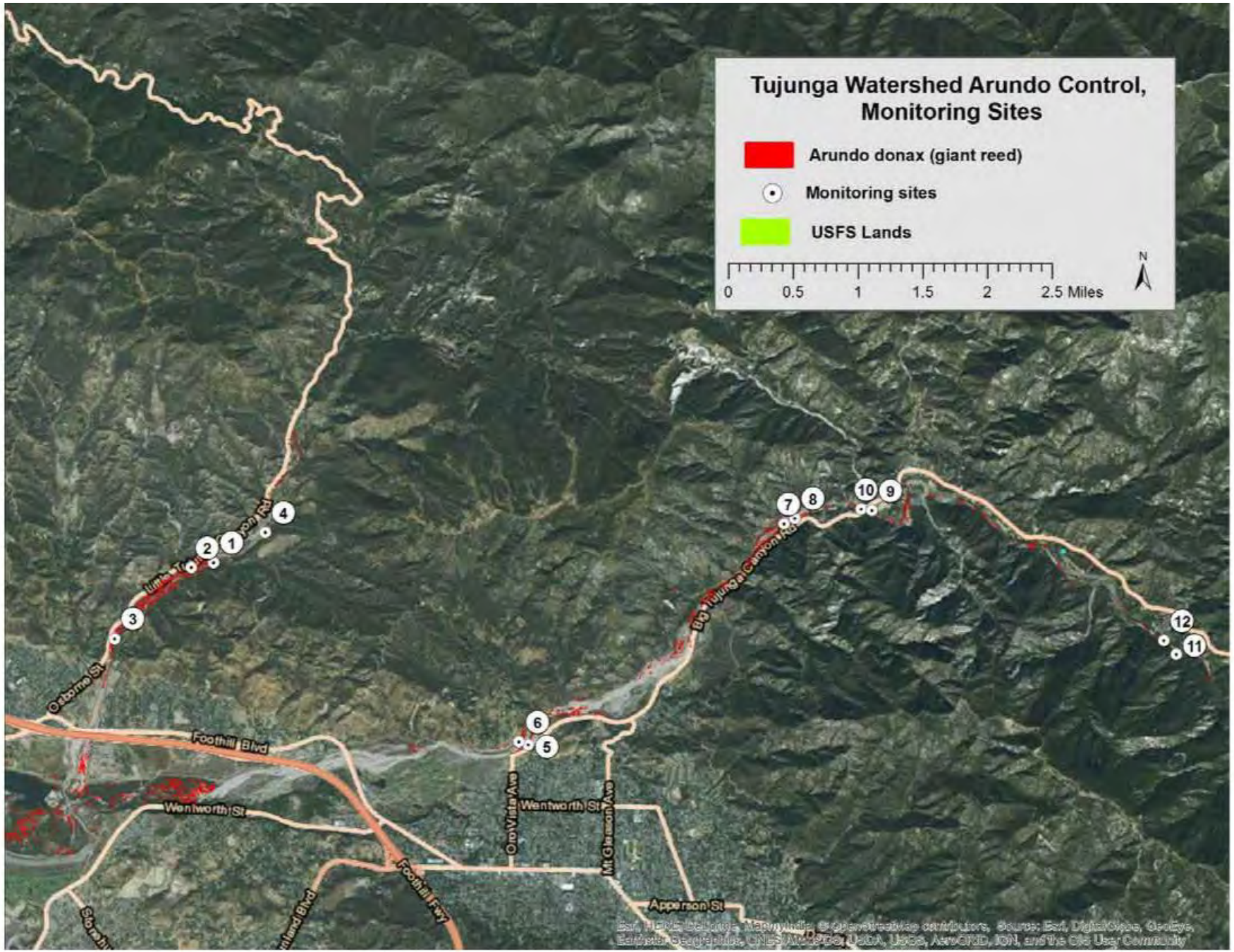
Table 2. Average Arundo cover and cane density on the twelve monitoring plots.

Year	Arundo Treatments	Native cover (average)	Non-native cover (average)	Notes:
2015	Before	5.0	0	Pre project condition (interpreted)
2017	Most cut, untreated	8.3	3.2	Sampled May 2017
2018	All under treatment	7.3	9.0	Sampled June 2018

Photo point monitoring:

Twelve monitoring photo points were established in late 2016 and early 2017 on Little Tujunga (4) and Big Tujunga (8) Watersheds (Appendix C). These photo points visually demonstrate the work cycle, Arundo control efficacy, and succession/recruitment of vegetation. The photo points are in the same general area as the monitoring transects (Appendix A and B). Before the treatment work Arundo stands were dense and expansive. Most Arundo stands were cut and chipped in 2017. Initial treatment of re-sprouts occurred in late 2017. Arundo is dead or absent on most photo monitoring sites in June 2018. Effects of the Creek fire in December 2017 on Little Tujunga are evident. Most native woody vegetation is re-sprouting.

Appendix A: Monitoring Transect Photos



Transect 1: 5-30-2017 Base stake to end point.

Transect 1: 6-15-2018 Base stake to end point.

Transect 2: 5-30-2017 Base stake to end point.

Transect 2: 6-15-2018 Base stake to end point.

Transect 3: 5-30-2017 Base stake to end point.

Transect 3: 6-15-2018 Base stake to end point.

Transect 4: 5-30-2017 Base stake to end point.

Transect 4: 6-15-2018 Base stake to end point.

Transect 5: 5-30-2017 Base stake to end point.

Transect 5: 6-15-2018 Base stake to end point.

Transect 6: 5-30-2017 Base stake to end point.

Transect 6: 6-15-2018 Base stake to end point.

Transect 7: 5-30-2017 Base stake to end point.

Transect 7: 6-15-2018 Base stake to end point.

Transect 8: 5-30-2017 Base stake to end point.

Transect 8: 6-15-2018 Base stake to end point.

Transect 9: 5-30-2017 Base stake to end point.

Transect 9: 6-15-2018 Base stake to end point.

Transect 10: Photo missing. 5-30-2017 Base stake to end point.

Transect 10: 6-15-2018 Base stake to end point

Transect 11: 5-30-2017 Base stake to end point.

Transect 11: 6-15-2018 Base stake to end point.

Transect 12: 5-30-2017 Base stake to end point.

Transect 12: 6-15-2018 Base stake to end point.

Appendix B: Transect data

Plot# 12/1/2015

	Arundo cover	Arundo density	NT	NS	NF	NG	Total native cover	NNS	NNF	NNG	Total non-native cover
1	80	410	0	0	0	0	0	0	0	0	0
2	80	410	0	0	0	0	0	0	0	0	0
3	80	410	0	0	0	0	0	0	0	0	0
4	80	410	0	0	0	0	0	0	0	0	0
5	80	410	0	0	0	0	0	0	0	0	0
6	80	410	0	0	0	0	0	0	0	0	0
7	80	410	0	0	0	0	0	0	0	0	0
8	80	410	0	0	0	0	0	0	0	0	0
9	80	410	0	0	0	0	0	0	0	0	0
10	80	410	60	0	0	0	60	0	0	0	0
11	80	410	0	0	0	0	0	0	0	0	0
12	80	410	0	0	0	0	0	0	0	0	0
Sum	960	4920	60	0	0	0	60	0	0	0	0
Ave	80	410	5	0	0	0	5	0	0	0	0

Sampled 5/30/2017

Plot #	Arundo cover	Arundo density	NT	NS	NF	NG	Total native cover	NNS	NNF	NNG	Total non-native cover	Treatment notes
1	85	222	0	5	0	0	5	0	0	0	0	Cut winter 16/17, no treatment, 3.5m tall
2	75	175	0	0	0	0	0	0	0	0	0	Cut winter 16/17, no treatment, 3m tall
3	35	183	0	0	0	0	0	0	1	1	2	Cut winter 16/17, one winter treatment, 3m tall
4	40	227	0	0	15	0	15	0	0	2	2	Cut winter 16/17, treated once, 3.5m tall
5	100	327	0	0	0	0	0	0	0	0	0	Cut and chipped winter 16/17, not treated yet, 4m tall
6	40	77	0	1	4	0	5	0	2	0	2	Cut and chipped fall 2016, treated once (winter), 2m tall
7	35	174	0	2	1	0	3	0	3	20	23	Cut fall 2016, one treatment (winter), 3.5m tall
8	40	142	2	1	3	0	6	0	1	0	1	Cut and chipped fall 2016, one re-treatment done (winter), 3m tall
9	90	342	0	0	0	0	0	0	1	1	2	Cut winter 2016/17, no treatment, 3m tall
10	90	517	60	0	1	0	61	0	1	3	4	Arundo cut winter 2016/17, no treatment, 4m tall
11	2	3	0	0	3	0	3	0	0	0	0	Cut and hauled 2015, treatment x2, some cane leaves slightly green
12	0	0	1	0	1	0	2	0	0	2	2	Cut 2015, treated two times
Sum	632	2389	63	9	28	0	100	0	9	29	38	
Ave	52.7	199.1	5.3	0.8	2.3	0.0	8.3	0.0	0.8	2.4	3.2	

Sampled 6/11/2018

Plot#	Arundo cover	Arundo density	NT	NS	NF	NG	Total native cover	NNS	NNF	NNG	Total non-native cover	Treatment notes
1	8	23	0	1	10	0	11	0	40	0	40	Burned 12-2017, treated fall 2017, about to be re-treated 6-18
2	0	0	0	0	1	0	1	0	4	1	5	Burned 12-2017, treated fall 2017, about to be re-treated 6-19
3	0	0	0	0	3	0	3	0	0	0	0	Burned 12-2017, re-treated fall 2017, about to be re-treated 6-18
4	0	0	0	0	0	0	0	0	0	0	0	Burned 12-2017, treated fall 2017, about to be re-treated 6-18, graded
5	3	12	0	0	0	0	0	0	0	0	0	Re-treated fall 2017, to be re-treated fall-18
6	8	7	0	0	2	0	2	0	14	0	14	Treated fall 2017, to be re-treated fall-18
7	0	0	0	0	1	0	1	0	3	5	8	Re-treated fall 2017, about to be re-treated 6-18
8	1	2	0	0	1	0	1	0	1	1	2	Re-treated fall 2017, about to be re-treated 6-18
9	5	18	0	0	0	0	0	0	1	0	1	Treated fall 2017, to be re-treated fall-18
10	3	1	60	0	0	0	60	0	0	0	0	Treated fall 2017, to be re-treated fall-18, tree cover pre-existing
11	0	0	0	0	2	1	3	15	0	1	16	Re-treated fall 2017, to be re-treated fall-18, tree tobbaco
12	0	0	1	0	4	0	5	0	2	20	22	Re-treated fall 2017, to be re-treated fall-18, some dead oak seedlings, one liv
Sum	23	63	61	1	24	1	87	15	65	28	108	
Ave	1.9	5.3	5.1	0.1	2.0	0.1	7.3	1.3	5.4	2.3	9.0	

Plot#	Species List	5/30/2017									
1	ARUDON	SAMMEX									
2	ARUDON										
3	ARUDON	SONOLE	BRODIA								
4	ARUDON	SONASP	HIRINC	BROMAD	HORVUL						
5	ARUDON										
6	ARUDON	DATWRI	SALMEL	BACPIL	SONOLE	hel ann					
7	ARUDON	PHACRA?	ERIFAS	BROMAD	BRODIA	HIRINC	EROCIC	CENMEL	NN COMP	VULMYU	AMBPSI
8	ARUDON	SALLAS	SALEXE	AMBPSI	XANSTR	SONOLE					
9	ARUDON	SONOLE	BROHOR	CHEALB							
10	ARUDON	CONCAN	CHEALB	SALLAS	PIPMIL						
11	ARUDON	SOLXAN									
12	BRODIA	AMBPSI	QUEAGR	PIPMIL	ARTDOU						
Plot#	Species List	6/15/2018									
1	ARUDON	LOTSCO	CALMAC	CHEAMB	DATWRI	HIRINC	PHACIC	SCROPHULARIA			
2	RINCON	CALMAC	BROMADR								
3	CONMAC	OENELA									
4											
5	ARUDON										
6	ARUDON	HELANN	DATWRI	CHEAMB	HIRINC						
7	CALMAC	PHACIC	HIRINC	BROMADR	BRODIA						
8	ARUDON	PHACIC	HIRINC	BROMADR							
9	ARUDON	HIRINC									
10	ARUDON	SALLAE									
11	GNACAL	PHACIC	ELYTRI	NIGGLA							
12	QUEAGR	GNACAL	AMBPSI	PHACIC	PIPMIL	CONCAN	CHEALB				

Appendix C: Photo Monitoring

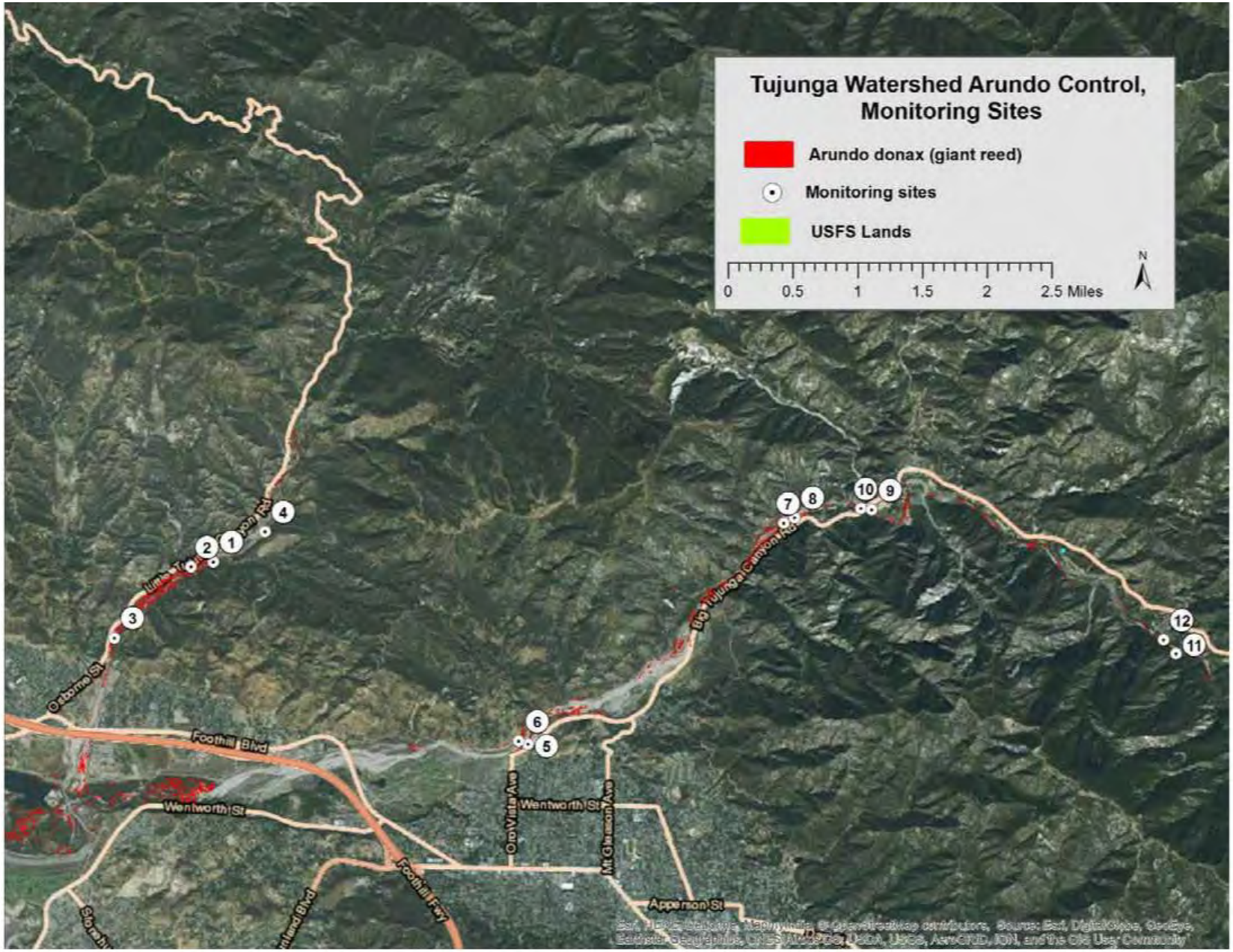


Photo point #1: Upper Middle Ranch, Little Tujunga: 2017-1-6 Before cutting and chipping.

Photo point #1: Upper Middle Ranch, Little Tujunga: 2017-1-8 After Cutting and chipping.

Photo point #1: Upper Middle Ranch, Little Tujunga: 2017-5-30 Arundo regrowth before first treatment.

Photo point #1: Upper Middle Ranch, Little Tujunga: 2018-6-15 Scattered Arundo regrowth before second treatment, site burned Dec 2017.

Photo point #2: Little Tujunga: 2016-11-1 Before cutting and chipping.

Photo point #2: Little Tujunga: 2017-1-6 After cutting and chipping.

Photo point #2: Little Tujunga: 2017-5-30 Arundo re-growth before first treatment.

Photo point #2: Little Tujunga: 2018-6-15 Scattered regrowth before second treatment, site burned Dec 2017.

Photo point #3: Lower Middle Ranch, Little Tujunga: 2016-9-27 Arundo before cutting and chipping.

Photo point #3: Lower Middle Ranch, Little Tujunga: 2017-2-16 Arundo winter re-growth just after first treatment.

Photo point #3: Lower Middle Ranch, Little Tujunga: 2017-5-30 Arundo spring re-growth just before treatment.

Photo point #3: Lower Middle Ranch, Little Tujunga: 2018-6-15 Scattered Arundo regrowth before second treatment, site burned Dec 2017.

Photo point #4: Upper Little Tujunga: 2016-2-22 Arundo before cutting and chipping.

Photo point #4: Upper Little Tujunga: 2017-2-16 Arundo after cutting and chipping.

Photo point #4: Upper Little Tujunga: 2017-5-30 Arundo before first treatment.

Photo point #4: Upper Little Tujunga: 2018-6-15 No Arundo regrowth before second treatment, site burned Dec 2017.

Photo point #5: Big Tujunga, Oro Vista: 2016-9-23 Arundo before cutting and chipping.

Photo point #5: Big Tujunga, Oro Vista: 2017-2-16 After cutting and chipping.

Photo point #5: Big Tujunga, Oro Vista: 201-5-30 Arundo re-growth before treatment.

Photo point #5: Big Tujunga, Oro Vista: 2018-6-15 Minimal Arundo regrowth, second treatment will be in fall 2018.

Photo point #6: Oro Vista Big Tujunga: 2016-9-26 Arundo before cutting and chipping.

Photo point #6: Oro Vista Big Tujunga: 2016-9-27 After cutting and chipping.

Photo point #6: Oro Vista Big Tujunga: 2017-1-17 Arundo winter re-growth and first treatment.

Photo point #6: Oro Vista Big Tujunga: 2017-5-30 Arundo spring re-growth just before second treatment.

Photo point #6: Oro Vista Big Tujunga: 2018-6-15 Minimal Arundo regrowth, second treatment will be in fall 2018.

Photo point #7: National Forest Cabin, Big Tujunga: 2015-12-10 Arundo before cutting and chipping.

Photo point #7: National Forest Cabin, Big Tujunga: 2017-2-16 After cutting and chipping, first treatment.

Photo point #7: National Forest Cabin, Big Tujunga: 2017-5-30 Arundo spring re-growth, before second treatment.

Photo point #7: National Forest Cabin, Big Tujunga: 2018-6-15 Minimal Arundo regrowth, second treatment will be in fall 2018.

Photo point #8: National Forest Cabin, Big Tujunga: 2016-10-5 Arundo before cutting and chipping.

Photo point #8: National Forest Cabin, Big Tujunga: 2016-10-5 Arundo after cutting and chipping.

Photo point #8: National Forest Cabin, Big Tujunga: 2017-1-8 Arundo winter growth and first treatment.

Photo point #8: National Forest Cabin, Big Tujunga: 2017-5-30 Arundo spring re-growth before second treatment.

Photo point #8: National Forest Cabin, Big Tujunga: 2018-6-15 Minimal Arundo regrowth, second treatment will be in fall 2018.

Photo point #9 Thundering Hooves, Big Tujunga: 2015-12-10 Arundo before cutting and chipping.

Photo point #9 Thundering Hooves, Big Tujunga: 2017-2-16 After cutting and chipping.

Photo point #9 Thundering Hooves, Big Tujunga: 2017-5-30 Arundo re-growth before first treatment.

Photo point #9 Thundering Hooves, Big Tujunga: 2018-6-15 Minimal regrowth, about to have second treatment.

Photo point #9B Thundering Hooves, Big Tujunga: 2017-1-5 Arundo before cutting and chipping.

Photo point #9B Thundering Hooves, Big Tujunga: 2017-2-16 After cutting and chipping.

Photo point #9B Thundering Hooves, Big Tujunga: 2017-5-30 Arundo spring re-growth before first treatment.

Photo point #9B Thundering Hooves, Big Tujunga: 2018-6-15 Minimal regrowth, about to have second treatment.

Photo point #10: Gorge, Big Tujunga: 2015-12-10 Arundo before cutting and chipping.

Photo point #10: Gorge, Big Tujunga: 2017-2-16 After cutting and chipping.

Photo point #10: Gorge, Big Tujunga: 2017-5-30 Arundo spring re-growth before first treatment.

Photo point #10: Gorge, Big Tujunga: 2018-6-15 Minimal Arundo regrowth, about to have second treatment.

Photo Point #11 Vogel Flat, Big Tujunga: 2016-1-25 Arundo before cutting and chipping.

Photo Point #11 Vogel Flat, Big Tujunga: 2016-2-22 After cutting and chipping.

Photo Point #11 Vogel Flat, Big Tujunga: 2017-2-16 Arundo re-growth after first treatmeant in fall 2015.

Photo Point #11 Vogel Flat, Big Tujunga: 2017-5-30 Arundo stand, no re-sprouts.

Photo Point #11 Vogel Flat, Big Tujunga: 2018-6-15 Minimal Arundo regrowth, second treatment will be in fall 2018.

Photo point #12: Vogel Flat Cabin, Big Tujunga: 2016-1-25 Arundo stand before cutting (stand is dormant).

Photo point #12: Vogel Flat Cabin, Big Tujunga: 2016-9-26 Arundo re-growth after first spring treatment.

Photo point #12: Vogel Flat Cabin, Big Tujunga: 2017-2-16 Arundo stand with no re-growth.

Photo point #12: Vogel Flat Cabin, Big Tujunga: 2017-5-30 Arundo stand with no re-growth.

Photo point #12: Vogel Flat Cabin, Big Tujunga: 2018-6-15 Minimal Arundo regrowth, second treatment will be in fall 2018.

Appendix C

Report of Conversation and Personal Communication with Bill Neill

From: Bill Neill <bgneill@earthlink.net>
Date: June 15, 2018 at 9:28:16 PM PDT
To: Wendy Katagi <wkatagi@stillwatersci.com>
Subject: FW: Photos of WMA-sponsored invasive weed control work near Devil Canyon & Big Tujunga Canyon

From: <bgneill@earthlink.net>
Date: Saturday, July 17, 2010 at 6:28 PM
To: Sherlan Neblett <SNeblett@acwm.lacounty.gov>, Drew Ready <drew@lasgrwc.org>, Debra Gillis <debragillis@sbcglobal.net>, Jason Casanova <cas@lasgrwc.org>, Nancy Steele <nancy@lasgrwc.org>, Ellen Mackey <emackey@mwdh2o.com>, Sabrina Drill <sldrill@ucdavis.edu>, Clifford McLean <cliff.mclean@verizon.net>, Steve Hartman <NatureBase@aol.com>, Jo Kitz <jkitz@mountainstrust.org>, Snowdy Dodson <snowdy.dodson@csun.edu>, Millie Jones <MJJones@lacbos.org>, Duncan Baird <duncanlbaird@gmail.com>, riverranch <riverranch@earthlink.net>, Kevin Rosen-Quan <kevinrosenquan@gmail.com>, Rob Driscoll <dryflyrob@aol.com>, Art Guglielmi <artg55@aol.com>, Steven Cole <Steven.Cole@WATER.LADWP.com>, Tania Bonfiglio <Tania.Bonfiglio@ladwp.com>, Janet Nickerman <jnickerman@fs.fed.us>, "J. Lopez" <jlopez@lacofd.org>, Rick Mayfield <rmayfield@dfg.ca.gov>, John Ekhoff <JEkhoff@dfg.ca.gov>, <Jesse_Bennett@fws.gov>, Chris Linardy <CLinardy@acwm.lacounty.gov>
Subject: Photos of WMA-sponsored invasive weed control work near Devil Canyon & Big Tujunga Canyon

To satisfy a requirement of the CDFA Base Funding grant program of the Los Angeles County Weed Management Area, I posted photos on the Flickr.com website showing results of WMA-sponsored post-fire invasive weed control work near the northwest and northeast corners of San Fernando Valley.

The link to these photos is:

<http://www.flickr.com/photos/21219306@N03/sets/72157624515310218/>

Clink on "slideshow" to view full-size photos, or "detail" to view smaller displays with captions.

The 31 photos are arranged in this order:

* 4 photos near Devil Canyon, north of Chatsworth and the 118 freeway beyond the end of Topanga Canyon Blvd., where the Santa Susana hills were burned by the Sesnon fire of 2008. The 2009 and 2010 Base Funding grant programs paid for herbicide treatment of about 1/2 acre of Arundo that did not burn inside the Indian Falls Estates gated community, plus smaller derivative clumps of post-fire Arundo resprouts located downstream in an undeveloped portion of Devil Canyon outside the gated community.

* 10 photos from several private parcels along Stonyvale Road at Vogel Flat in Big Tujunga Canyon, burned by the Station fire of August-September 2009. At Vogel Flat I obtained permission to treat about 2/3 of the Arundo resprouts (less than 1/8 acre), 1/3 of the Ailanthus root suckers, and nearly all Spanish broom on private land.

* 8 photos from Rancho Ybarra Christian Camp and Conference Center at 3150 Big Tujunga

Canyon Road, located about 2/3 mile downstream from Vogel Flat. This 120-acre property contains about 2/3 net acre of Arundo on the canyon floor that, according to the owner, was not present before heavy flooding in 1978.

* 9 photos from the upper end of Big Tujunga Wash, just outside the Angeles National Forest boundary, on property owned privately and by City of Los Angeles Dept. Water & Power. Primary targets for herbicide application were post-fire upland Arundo and castor bean along the northwest margin, above the active flood zone; Spanish broom near the active channel; Ailanthus and castor bean on unburned land bordering the wash to the southeast.

Project funding for 2010 was approved on April 27 by the Los Angeles County Weed Management Area. Subsequently, I contacted property owners at Vogel Flat in Big Tujunga Canyon with assistance from Supervisor Antonovich's office. Herbicide application work totaling 20.5 hours was conducted near Devil Canyon on May 29 and on five trips to Big Tujunga Canyon from May 31 to June 22. Additional minor follow-up work will be volunteered during July, with expenses paid by the LA/SMM Chapter of CA Native Plant Society.

From: Bill Neill <bgneill@earthlink.net>
Date: June 15, 2018 at 9:29:57 PM PDT
To: Wendy Katagi <wkatagi@stillwatersci.com>
Subject: FW: Progress to Oct. 11 at western half Hansen Dam basin

From: Bill Neill <bgneill@earthlink.net>
Date: Wednesday, October 12, 2016 at 9:08 AM
To: Robert Skillman <rskillman@lacorps.org>, Edward Belden <ebelden@nationalforests.org>, Jason Giessow <jgiessow@cox.net>, Viet Tran <vtran@lacorps.org>
Subject: Progress to Oct. 11 at western half Hansen Dam basin

Yesterday I completed herbicide treatment of accessible green Arundo foliage at upland areas west of the Little Tujunga channel and northwest of the dam gates. During 7 hours since Sept. 28, I applied 50 oz Polaris herbicide diluted in 12.5 gallon water to 28 Arundo clumps that I counted, and a similar number that I did not count near homeless camps east of the Aquatic Center and south of the Foothill parking lot.

I am annotating a aerial-photo map with treated clumps and unmapped, untreated clumps that I will mail to Jason, after I venture into the basin's eastern half, east of the Little Tujunga channel. One unmapped Arundo area in the western half deserves mention: Several larger stands totaling about 1/4 acre, somewhat concealed by trees, along the edge of the woodland area just west of the Little Tujunga outlet. In my opinion these larger stands could be tractor-mowed easily and quickly, because they are accessible and located on level, rock-free ground. I understand that "heavy equipment" including tractor mowers are not allowed by the CDFW agreement; but if this option can be added for a light-weight rotary mower, I can recommend Oakridge Landscape, Inc., based in Santa Clarita, based on excellent performance several years ago at Bonelli Regional Park in San Dimas.

Also yesterday, I sprayed Arundo resprouts for an hour at the Oro Vista community removal project area upstream of the Oro Vista crossing. In addition

to taller stalks that I had missed last May, yesterday I sprayed numerous short stalks that had sprouted during the summer. These short stalks are a good example of late-sprouting Arundo — cut last winter, but not sprouted until summer — that I expect to see in some areas at Hansen Dam basin. During our October 4 conference call, Robert said that including this Oro Vista clearing in the NFF/LACC project would require an addition to my "Scope of Work" Attachment A, which I declined because I thought the remaining work would be minimal. However if the term of my contractor agreement with LACC is extended beyond March 15, in order to control late-sprouting Arundo next spring, then I would appreciate the addition of the Oro Vista area to the Scope of Work.

During the October 4 conference call, we discussed the option of obtaining nesting surveys to enable work during nesting season. Then during email communications about summer-dormant Arundo in the dry, sandy channels, Jason advised that new stalks in these dry areas should be sprayed in a major effort just before March 15. However I expect that some stalks will sprout and grow after March 15, yet will be dormant by next fall, so will require herbicide treatment during nesting season. The CDFW agreement in section 2.10 does allow "limited non-mechanized passive backpack work" during nesting season, which I believe may result from my communications with biologist Betty Courtney about 12 years ago.

From: Bill Neill <bgneill@earthlink.net>
Date: June 15, 2018 at 9:30:33 PM PDT
To: Wendy Katagi <wkatagi@stillwatersci.com>
Subject: FW: Progress during Oct. 13-16 at Hansen Dam basin

From: Bill Neill <bgneill@earthlink.net>
Date: Monday, October 17, 2016 at 7:45 AM
To: Robert Skillman <rskillman@lacorps.org>, Edward Belden <ebelden@nationalforests.org>, Jason Giessow <jgiessow@cox.net>, Viet Tran <vtran@lacorps.org>
Subject: Progress during Oct. 13-16 at Hansen Dam basin

During four consecutive days, October 13-16, I worked 14.5 hours and applied 153 oz or 1.2 gallons of Polaris herbicide diluted in 38 gallons water. Most activity was in a wide strip extending southward from Little Tujunga Wash to the dam. I will work elsewhere during the week of October 17 so will not return to Hansen Dam basin until the week of October 24.

Some of the Arundo clumps that I sprayed are colored red on the Figure 5 project map, so are designated as "cut and chip" by LACC. Where I can easily access and spray green Arundo foliage of relatively small discrete clumps mapped with red color, I will take the opportunity to get herbicide into the roots at an early date. Also, in the LACC area east of the ACS area, I have targeted upland clumps at dry locations that commonly have mostly dead or desiccated

stalks with a lesser number of year-old green stalks. Spraying the succulent green foliage of a partly dormant clump ensures that the active root network receives herbicide, which might not happen if all stalks are cut first.

Area reports:

South of Equestrian Center & Orcas Park: Along the base of slope bordering the riparian corridor, I sprayed 5 Arundo clumps and portions of 2 clumps that will require crew removal. Also several fig trees, juvenile fan palms, pampas grass, a Peruvian pepper and Chinese elm.

East end under transmission lines: To initiate herbicide treatment at the basin's east end, I sprayed 5 Arundo clumps beneath power lines that mark the upstream boundary of the flood control basin. I saw that from 0.1 mile to 0.3 mile west of the power lines, a recent fire burned the northern edge of the riparian corridor. Online news reports from Sept. 27 described the burn area as 21 acres. I had estimated that the fire was 4 weeks ago, judging from the growth of resprouting Arundo stalks 2 to 3 feet tall.

Lower end of Little Tujunga Wash: I sprayed sparse green foliage of mostly dormant small clumps located on the open sandy floor of the wash, leaving larger stands on the margins for later.

North of dam gates: Along the banks of the dry low-flow channel, I treated about 12 small clumps shaded by tall willow trees, within about 1/4 miles of the dam outlet. I stopped moving upstream at larger infestations that will require crew removal. This was the only location where I sprayed within the ACS area.

Southeast burn area: Next to the dam near its eastern end, a half-acre Arundo infestation burned probably 12 to 18 months ago, possibly after the Figure 5 map was generated. With Garlon 4 herbicide, I sprayed about 20 castor bean plants sprouted by the fire; and with about 40 oz Polaris, I sprayed densely spaced post-fire Arundo resprouts 6 to 16 feet tall.

Trail from burn area to concrete slabs: From the base of the dam near the southeast burn area, an equestrian/hiking trail heads north toward Tujunga Wash and intersects a dirt road, bordered by stacked concrete slabs, that descends from the top of the dam near Wentworth Street. I sprayed sparse green stalks of upland clumps west of the trail, near the burn area and near the trail's north end.

From: Bill Neill <bgneill@earthlink.net>
Date: June 15, 2018 at 9:31:42 PM PDT
To: Wendy Katagi <wkatagi@stillwatersci.com>
Subject: FW: Progress during Oct. 23-Nov. 1 at Hansen Dam basin

From: Bill Neill <bgneill@earthlink.net>
Date: Tuesday, November 1, 2016 at 6:41 PM
To: Robert Skillman <rskillman@lacorps.org>, Edward Belden <ebelden@nationalforests.org>,

Jason Giessow <jgiessow@cox.net>, Viet Tran <vtran@lacorps.org>
Subject: Progress during Oct. 23-Nov. 1 at Hansen Dam basin

During 5 of the past 10 days, I worked 18.5 hours and applied 196 oz or 1.53 gallons of Polaris herbicide diluted in 49 gallons water. I have annotated a Figure 5 map that I will give to Jason showing past treatment locations, as of Nov. 1. I have added two colors/symbols to the map legend:

>Solid Green = Sprayed

>Cross-hatched green = Sprayed "upland" clumps that are partly or mostly dormant

Also I converted yellow areas to red where a crew will be required for biomass removal or cutting access trails.

Little Tujunga Wash: I mapped the broad sandy channel floor, west of the equestrian center, as "upland" because Arundo clumps are water-deprived. Short Arundo clumps on the wash floor appear to be mostly dead or dormant when viewed from a distance, but some have succulent green stalks, which I sprayed.

Further downstream, where Little Tujunga Wash joins the main Tujunga Wash, Arundo stalks are tall and green and intermixed with trees around the margin of the open wash floor. I sprayed tall Arundo stalks where accessible and isolated, but by-passed Arundo stalks where intermixed with tree foliage; so this area will require a significant amount of biomass removal, more than is shown on the Figure 5 map. These infestations are relatively young, so the stalks are widely spaced and removal work should go fast. The area has a number of homeless camps, both active and abandoned.

East end of Tujunga Wash: The largest Arundo infestations in the basin are located at the east end, along the interface between open rocky terrain and dense woodland, where Arundo stalks and rhizome fragments transported by floods were snagged by trees and became rooted. Currently I'm spraying all Arundo foliage that's accessible, without contacting the trees.

Northeast burn area: Following the wildfire of Sept. 27, some resprouts are now 7 feet tall and growing about one foot per week. I will start spraying post-fire resprouts in mid-November, after the shorter stalks grow taller and develop leaves.

After I complete herbicide treatments at the basin's east end, I won't have much to do after November until a crew can assist by cutting access trails through dense woodland areas.

I have taken photos of some areas to document future progress of herbicide treatments. The attached photo, taken from the dam, shows the "southeast burn area" that I described in my report of October 17.

From: Bill Neill <bgneill@earthlink.net>
Date: June 15, 2018 at 9:31:59 PM PDT
To: Wendy Katagi <wkatagi@stillwatersci.com>
Subject: FW: Nov. 7 update at Hansen Dam basin

From: Bill Neill <bgneill@earthlink.net>
Date: Monday, November 7, 2016 at 8:46 PM
To: Robert Skillman <rskillman@lacorps.org>, Edward Belden <ebelden@nationalforests.org>, Jason Giessow <jgiessow@cox.net>, Viet Tran <vtran@lacorps.org>
Subject: Nov. 7 update at Hansen Dam basin

After a 5 day absence while I attended the annual Cal-IPC Symposium near Yosemite, today I returned to Hansen Dam basin and at the outset, I took several photos from the high ridge south of Wentworth Street. The attached photo shows the far east end of the project area, where Arundo stalks and rhizome fragments carried by floods down Tujunga Wash were snagged by trees and became rooted, forming the largest, densest infestations in the flood control basin. On the photo's left side, the orange-brown foliage defines the area burned by the Sept. 27 wildfire. From this vantage point, the Arundo clumps sprayed during late October will become apparent in several months.

After taking several photos, I sprayed several Arundo clumps along the Wentworth Street fence, then spent 4.5 hours spraying perhaps one-third of the post-fire Arundo resprouts, between 3 and 8 feet tall, in the northeast burn area. The second attached photo was taken one week ago, when resprouts were one foot shorter. Completing the initial herbicide treatment of post-fire resprouts is likely to take another 10 hours, and a similar amount of labor will be

needed next spring to treat stalks that sprout and grow after some rain falls during winter months.

At the Cal-IPC Symposium last week, I talked about 20 minutes with Greg Omari from ACS Habitat Management, whom I have known for 16 years. When I showed Greg my annotated Figure 5 map, which shows 9.4 acres to be cut and chipped by ACS crews, Greg responded that his employees are tediously cutting and chipping Arundo at Middle Ranch on Little Tujunga Wash, so will not be available to work at Hansen Dam basin. Greg and I agree that much of Little Tujunga Wash is suitable for biomass reduction by tractor mowing; so this morning I sent an inquiry to Dept. Fish & Wildlife, and received a reply that I'll forward separately.

In the eastern project area, I believe that the Figure 5 map underestimates the amount of Arundo somewhat concealed by the tree canopy, and at numerous locations I will request assistance after November by either ACS or LACC crews to cut access trails to and around sprayable clumps, in addition to cutting and chipping clumps that cannot be safely foliar sprayed due to intermixed trees.

From: Bill Neill <bgneill@earthlink.net>
Date: June 15, 2018 at 9:32:36 PM PDT
To: Wendy Katagi <wkatagi@stillwatersci.com>
Subject: FW: Progress to Nov. 15 at Hansen Dam basin

From: Bill Neill <bgneill@earthlink.net>
Date: Wednesday, November 16, 2016 at 7:06 AM
To: Robert Skillman <rskillman@lacorps.org>, Edward Belden <ebelden@nationalforests.org>, Jason Giessow <jgiessow@cox.net>, Viet Tran <vtran@lacorps.org>
Subject: Progress to Nov. 15 at Hansen Dam basin

Yesterday I completed herbicide treatments of post-fire Arundo resprouts at the project's northeast corner, burned by wildfire on Sept. 27. This effort required about 18 hours of labor over 4 days to apply 1.8 gallons of Polaris/imazapyr herbicide diluted in 58 gallons water. Seven weeks after the fire, some Arundo stalks had grown to 10 feet, but most were about 6 feet tall.

The attached photo shows about one acre of post-fire Arundo resprouts, among numerous burnt trunks of white alder trees that have not resprouted, plus burnt willow trees with resprouts about 2 feet tall. News reports described the burn area as 21 acres, of which I estimate about 5 to 7 acres contain abundant Arundo, formed of numerous, closely spaced small clumps, up to 20 feet across, rather than large dense stands. Before the fire, the area photographed would have been nearly impassable due to blockage by recumbant Arundo stalks.

Separately I'm submitting my first invoice to Los Angeles Conservation Corps for expenses since late September, covering 60 hours of labor and over $600 for

herbicide. During this initial period I have targeted Arundo foliage that is accessible and easily sprayed — in two post-fire areas; in several upland areas and Little Tujunga Wash, where water-deprived clumps are short and partly dormant; and along open, rocky/sandy flood channels at the project's eastern end. Next I will venture into the large woodland of Big Tujunga Wash east of Little Tujunga, where hiking distances are longer and access more difficult. At any time I would welcome participation by ACS or LACC crews to cut access trails and reduce biomass.

If neither ACS or LACC crews are available, could county or state fire crews assist by cutting trails after fire season is over? Whoever cut fire breaks around the Sept. 21 burn area accomplished an impressive amount of work in a short time.

From: Bill Neill <bgneill@earthlink.net>
Date: June 15, 2018 at 9:33:18 PM PDT
To: Wendy Katagi <wkatagi@stillwatersci.com>
Subject: FW: Discussions about allowing mower operation

From: Bill Neill <bgneill@earthlink.net>
Date: Wednesday, November 30, 2016 at 9:29 AM
To: Edward Belden <ebelden@nationalforests.org>, Jason Giessow <jgiessow@cox.net>
Cc: Robert Skillman <rskillman@lacorps.org>, Viet Tran <vtran@lacorps.org>, Carvel Bass

<Carvel.H.Bass@usace.army.mil>
Subject: Discussions about allowing mower operation

Since my last progress report of Nov. 16, I've moved westward from spraying Arundo near the basin's eastern end, to areas south of Orcas Park, where I've encountered several Arundo stands that are amenable to tractor mowing & mulching. As shown by the attached photo, in places the terrain is level and sandy, and lacks the large boulders and down timber and closely spaced trees that would prevent mower access at the basin's upstream end.

Last Monday I mentioned my interest in mower operation via an email message to Carvel Bass, ecologist with the Army Corps of Engineers Operation Branch, who is temporarily working in Louisiana. Since 1999 Carvel has been my contact for invasive weed control work at local Army Corps' facilities — not only Hansen Dam basin, but also Whittier Narrows, Sepulveda Dam, Santa Fe Dam, Prado Dam, Carbon Canyon and Glendale Narrows.

Carvel pointed out that Daniel Swenson, addressed on the USFWS consultation letter, heads the Army Corps' Regulatory Branch in Los Angeles, not the Operations Branch that manages Hansen Dam basin. Carvel will return to Los Angeles on Dec. 16, and is copied on this message; he said that he can deal with requesting permission for mower operation after he returns.

Regarding the consultation letter from US Fish & Wildlife Service, yesterday I talked to Jesse Bennett at the USFWS Carlsbad office, whose number 760-431-9440 ext. 305 is listed at the end of the consultation letter. Jesse told me that he could issue a short amendment to permit mower operation, if he receives a request from the Army Corps' Regulatory Branch, for which he gave me the name and number of Jessica Vargas. This morning I spoke briefly with Jessica Vargas, with the Army Corps' Regulatory Branch, at 213-452-3409, who said that she would submit a request to Jesse Bennett, upon receiving a request from National Forest Foundation. She said that her office was contacted for a Army Corps 404 permit to allow vehicle access to riparian areas, and that the 404 permit does not exclude mower operation so it would not require amendment.

From: Bill Neill <bgneill@earthlink.net>
Date: June 15, 2018 at 9:34:13 PM PDT
To: Wendy Katagi <wkatagi@stillwatersci.com>
Subject: FW: January 7 update at Hansen Dam basin

From: Bill Neill <bgneill@earthlink.net>
Date: Saturday, January 7, 2017 at 8:03 AM
To: Edward Belden <ebelden@nationalforests.org>, Robert Skillman <rskillman@lacorps.org>, Viet Tran <vtran@lacorps.org>, Jason Giessow <jgiessow@cox.net>
Cc: Jason Casanova <cas@watershedhealth.org>
Subject: January 7 update at Hansen Dam basin

Since late December, Ed Grandpre and his LACC crew have worked 4 days at Hansen Dam basin — Dec. 19, 21, 28 and Jan. 6. On the first day, Ed supervised 4 crew members with one chainsaw and hand tools; then subsequently he brought 5 or 7 crew members with 2 chainsaws.

Our original plan was to divide the crew's time between Hansen Dam and Big Tujunga Canyon, with Mondays and Wednesday at Hansen Dam, and Tuesdays and Thursdays at Big Tujunga Canyon. But the schedule of Monday holidays has reduced the crew's time at Hansen Dam. Nonetheless a considerable amount of trail clearance work has been completed in the central portion of the basin's eastern half.

The basin's elongated eastern half is divided into three segments by four landmarks that cross the flood channel — the landmarks are either road, equestrian trail, or power line. From west to east, these landmarks include:

(1) A vehicle route travelled by park rangers crosses the main stream channel from the west side of the Little Tujunga channel to an elevated area south of the confluence and then southeastward to the dam's east end.

(2) A wide equestrian trail extends southwestward from the west side of Orcas Park next to the Equestrian Center.

(3) The western power line extends southeastward from the east side of Orcas Park to bluffs above Wentworth Street.

(4) The eastern power line extends southwestward from the end of Wheatland Street by the I-210 freeway, to bluffs above Wentworth Street.

Most trail clearance work by the crew has been within the central segment -- beneath and downstream from the western power line, and as far west as the main equestrian crossing. Although initially I thought the Arundo is distributed fairly randomly within this segment, we found that the largest and densest stands border the primary stream channel that flows from near the northeast corner to near the southwest corner. These Arundo concentrations do not appear to be completely displayed on the Figure 5 map, possibly because they were not previously accessible or visible from existing trails.

The largest Arundo stand has an area of about 3 acres, east of the equestrian crossing and northwest of the stream channel. The crew has cut trails around the outside perimeter and into the interior. Due to its size, this area will require tractor mowing/mulching, which should be scheduled for next fall rather than this winter, because the ground is too soft and muddy from recent rain.

Elsewhere, on sandy soil with drainage near the Little Tujunga confluence, tractor mowing can be done in late January or February without any problem.

During November I sprayed Arundo mainly in the eastern half of the eastern segment — post-fire resprouts in the recent burn area and discrete tall clumps on open rocky terrain downstream from the eastern power line. On January 6 I returned to the burn area to spray several small areas of resprouts that I had missed in November. The attached two photos were taken within a concentration of treated Arundo resprouts, with views to the southwest and northwest. The Arundo foliage treated with imazapyr herbicide is partly yellow, especially at the growing tips, whereas untreated foliage is entirely green.

Although Arundo clumps are relatively small in the northeast burn area, they are so numerous that access to the area would have been difficult before the fire, due to the density of recumbent stalks plus fallen branches and debris. In the unburned western half of this segment, Arundo is similarly dispersed as small

clumps among numerous tall trees and down timber, and will be difficult to access and treat.

As I continue to work at Hansen Dam basin, I'm curious about the long-term plan. The CDFW Streambed Alteration Agreement is valid until March 2020, but will the project budget last until then? What will constitute project completion expected by the grant funders?

Also on the CDFW permit, I noticed section 2.16, Notification of Invasive Species, that requires permittee to notify CDFW of invasive species not previously known to occur within project site. Were pampas grass, and saplings of eucalyptus and Brazilian pepper tree previously known? I have sprayed small numbers of each while treating still-green Arundo which is rare.

From: Bill Neill <bgneill@earthlink.net>
Date: June 15, 2018 at 9:34:32 PM PDT
To: Wendy Katagi <wkatagi@stillwatersci.com>
Subject: FW: Jan. 16 update at Hansen Dam Arundo Project

From: Bill Neill <bgneill@earthlink.net>
Date: Monday, January 16, 2017 at 8:02 PM
To: Edward Belden <ebelden@nationalforests.org>, Robert Skillman <rskillman@lacorps.org>, Viet Tran <vtran@lacorps.org>
Cc: Jason Giessow <jgiessow@cox.net>
Subject: Jan. 16 update at Hansen Dam Arundo Project

Today Ed Grandpre brought 7 crew members with 3 chainsaws, who cut access trails during the morning mostly west of the main equestrian crossing. Then around 10 am, Viet Tran arrived with Veronica and crew of about 10 with loppers. I led Viet and Veronica's crew on a tour through the northeast burn area, that I had sprayed in November; and we found that the area they were seeking, marked red on the Figure 5 map, was swampy and difficult to access, so I showed them an area suitable for manual removal near the south end of Little Tujunga Wash.

Using loppers, Veronica's crew cut relatively young and widely spaced Arundo stalks from among tree saplings, that I could not spray last October. This area

of manual removal is between the open wash further upstream/north, with few trees and numerous drought-stressed small Arundo clumps that I sprayed last October, and to the south, dense Arundo under large trees further downstream in stands too large and old to be manually removed but which are suitable for tractor mowing.

Veronica's crew neatly piled the cut stalks on an adjacent sandy clearing, where the piles can be mulched quickly by a tractor mower, rather than fed to a chipper, when a tractor mower is introduced for mowing the large dense Arundo stands further downstream.

After lunch, Ed's crew also moved to Little Tujunga Wash and cut trails around one of the largest stands, marked red on the Figure 5 map, so that we could see where several abandoned homeless camps are located before mowing.

Although about 2 inches of rain fell at the basin last week, the sandy soil at Little Tujunga Wash was firm today, so this area is suitable for tractor mowing in late January or February, after drying out from a storm next weekend. On Dec. 20 I recommended Oakridge Landscape for this service, based in San Fernando Valley and Santa Clarita. Four days of mower operation at $130/hour (2012 price) would clear several acres of dense Arundo stands near the Big Tujunga/Little Tujunga confluence, which would be a major accomplishment. The mower could also work east of the Aquatic Center, on clumps colored red on the Figure 5 map, after trash from abandoned homeless camps is removed by LACC crews.

From: Bill Neill <bgneill@earthlink.net>
Date: Tuesday, December 20, 2016 at 2:32 PM
To: Edward Belden <ebelden@nationalforests.org>, Robert Skillman <rskillman@lacorps.org>, Viet Tran <vtran@lacorps.org>
Subject: Dec. 20 update at Hansen Dam Arundo Project

Yesterday, following a short tour for Viet Tran, I was assisted by an LACC crew for the first time — Ed Grandpre and 4 members, equipped with a chainsaw and hand saws. Initially we cleared around several Arundo clumps along the flood basin's north edge, near the Equestrian Center and Orcas Park. But we soon encountered swampy conditions, probably worsened by recent rain, so we moved eastward/upstream to higher ground, and there accomplished a significant amount of trail clearance work, clearing access to about 30 or 40 Arundo clumps within several acres.

Our current plan is that the crew will work with me twice a week, on Mondays and Wednesdays, and return to Big Tujunga Canyon on Tuesdays and Thursdays.

This afternoon I talked by telephone to Greg Omari with ACS Habitat Management, for the first time since Greg and I met at the Cal-IPC Symposium in early November. My question was whether Greg's company owns and

operates a tractor mower; and the answer was that ACS Habitat does have a mower but it's larger and heavier than the Bobcat-size tractor that I was seeking. After permit amendments are approved to allow a relatively light-weight mower, I recommend Oakridge Landscape for this service, based in San Fernando Valley and Santa Clarita. Contact is Richard Dunbar, Erosion Control Division Manager, at 818-891-0468 ext 119, or cell 818-612-8038.

From: "Bill Neill" <bgneill@earthlink.net>
To: "Wendy Katagi" <wkatagi@stillwatersci.com>
Subject: FW: Photos of Hansen Dam project

From: Bill Neill <bgneill@earthlink.net>
Date: Sunday, April 2, 2017 at 10:40 AM
To: Edward Belden <ebelden@nationalforests.org>, Robert Skillman <rskillman@lacorps.org>, Jason Giessow <jgiessow@cox.net>
Cc: Jason Casanova <cas@watershedhealth.org>, Carvel Bass <Carvel.H.Bass@usace.army.mil>
Subject: Photos of Hansen Dam project

After a two-week recess, last Wednesday I returned to Hansen Dam basin to complete herbicide treatments on Little Tujunga Wash below the I-210 crossing, and yesterday I resumed work near the mowed Arundo stand south of the stream channel.

I promised to send photos of the mowed areas, but I'm waiting until Arundo resprouts grow several feet. The attached photos show results of herbicide applications last fall south of the stream channel.

Photo 1 (14.27.54): A well-watered clump next to the stream channel, with stalks approaching 30 feet tall and no sign of recent growth.

Photo 2 (16.50.40): Dead post-fire resprouts that I call the "southeast burn area", at the base of the dam near its east end. I estimate that the fire occurred during the summer of 2015, but due to drought conditions, post-fire resprouts grew only about 10 feet tall.

Photo 3 (16.53.18): In the interior of the southeast burn area, three small clumps did not get enough herbicide so have resprouted, but the larger stands behind these small clumps are completely dead.

Photo 4 (16.56.30) shows about half of the southeast burn area, with a net area of about 1 acre. The upper part of the rock dam is visible above photo center.

Photo 5 (17.42.15): Further into the basin, a coalesced row of large Arundo clumps is located on the slope break between upland terrace and riparian woodland, with no sign of recent growth.

Photo 6 (17.43.36): On the upland terrace near the southeast burn area, small clumps are dependent on rainwater so are drought-stressed during summer months with growth limited to about 16 feet. The clump on the left may have been mostly dormant last fall, so presumably was not sprayed and is now resprouting; whereas the dead clump on the right probably had some green foliage last fall that was sprayed.

From: "Bill Neill" <bgneill@earthlink.net>
To: "Wendy Katagi" <wkatagi@stillwatersci.com>
Subject: FW: April 14 photos of Hansen Dam Arundo project

From: Bill Neill <bgneill@earthlink.net>
Date: Saturday, April 15, 2017 at 8:50 PM
To: Edward Belden <ebelden@nationalforests.org>, Robert Skillman <rskillman@lacorps.org>, Jason Giessow <jgiessow@cox.net>
Cc: Jason Casanova <cas@watershedhealth.org>, Carvel Bass <Carvel.H.Bass@usace.army.mil>
Subject: April 14 photos of Hansen Dam Arundo project

Photo 1 (09.57.35) views the east end of the project area from a hilltop south of Wentworth Street, showing defoliated tall Arundo clumps sprayed last November on the open rocky wash upstream of woodland areas.

Photo 2 (11.51.41) is the same hilltop view, taken last November when the Arundo was still green.

Photo 3 (09.58.20) is a close-up view of the defoliated clumps. The east end of the "northeast burn area" is in the upper left corner.

Photo 4 (16.47.12) shows a resprouting Arundo clump on a grassy upland area about 1/4 mile northeast of the dam spillway. The clump was dormant or nearly

dormant during drought years, but has been revived by winter rain. On these upland clumps, it's important to apply herbicide during periods of lush growth, before they turn mostly dormant again for possibly several years of drought.

From: "Bill Neill" <bgneill@earthlink.net>
To: "Wendy Katagi" <wkatagi@stillwatersci.com>
Subject: FW: Photos of mowed area east of Little Tujunga Wash

From: Bill Neill <bgneill@earthlink.net>
Date: Friday, April 21, 2017 at 5:09 AM
To: Edward Belden <ebelden@nationalforests.org>, Robert Skillman <rskillman@lacorps.org>, Jason Giessow <jgiessow@cox.net>
Subject: Photos of mowed area east of Little Tujunga Wash

The first four photos were taken on March 7, during the first day of mower operation at the large Arundo stand on the east side of Little Tujunga Wash, immediately south of the Hansen Dam Equestrian Center.

Photo 5 was taken on March 8, during the second day of mower operation.

Photo 6 was taken on April 20, 6 weeks after clearance work. For scale, my backpack sprayer is visible to the left of center. The cleared area is about 200 feet across, so about one acre. The tallest Arundo resprouts are 10 feet tall but most are 4 to 6 feet tall, and some are emerging from the ground. Some cleared areas have low piles of cut stalks that were cut and removed manually from among surrounding trees, that can be mulched next fall if the mower returns.

From: "Bill Neill" <bgneill@earthlink.net>
To: "Wendy Katagi" <wkatagi@stillwatersci.com>
Subject: FW: Photos of mowed area southwest of Little Tujunga/Big Tujunga confluence

From: Bill Neill <bgneill@earthlink.net>
Date: Friday, April 21, 2017 at 5:09 AM
To: Edward Belden <ebelden@nationalforests.org>, Robert Skillman <rskillman@lacorps.org>, Jason Giessow <jgiessow@cox.net>
Subject: Photos of mowed area southwest of Little Tujunga/Big Tujunga confluence

The second large Arundo stand was partly mowed on March 13-14 and is located about 500 feet southwest of the vehicle-route stream crossing near the confluence of Little Tujunga and Big Tujunga. Photo 1 shows progress after the first hour of mower operation on March 13.

Photos 2-5 taken on April 20 show that due to limited time before nesting season started, large sections of Arundo were left standing, and the mower cut "aisles" about 15 to 40 feet wide, from which the uncut sections could be sprayed later.

Photo 2 shows the entrance to the stand, near the same location as Photo 1.

Photo 3 shows the longest cleared aisle along the north edge of the Arundo stand, which is to the right.

Photos 4 & 5 show two spur aisles that cut southward into the main body of the stand.

The uncut sections were sprayed 3 weeks before the April 20 photos, so have not yet turned yellow. By next fall the uncut sections will be dead or mostly dead, and can be left standing to disintegrate gradually, or can be mowed & mulched if mower operation can be continued.

From: "Bill Neill" <bgneill@earthlink.net>
To: "Wendy Katagi" <wkatagi@stillwatersci.com>
Subject: FW: May 12 update at Hansen Dam basin

From: Bill Neill <bgneill@earthlink.net>
Date: Friday, May 12, 2017 at 6:05 AM
To: Edward Belden <ebelden@nationalforests.org>, Robert Skillman <rskillman@lacorps.org>, Jason Giessow <jgiessow@cox.net>
Cc: Jason Casanova <cas@watershedhealth.org>, Carvel Bass <Carvel.H.Bass@usace.army.mil>
Subject: May 12 update at Hansen Dam basin

On Monday I completed herbicide treatment of drought-stressed Arundo clumps on the central upland area southeast of the lake and northeast of the dam gates. During the four weeks since mid-April, this effort required about 17 hours divided between 6 days.

Also on Monday and yesterday, I sprayed dense Arundo stands along a former lake shore, that I accessed by walking across the central upland. Before last winter, this Arundo was located near lake water, but flooding during February deposited a broad sandy delta that moved the lake shore about 300 feet northward.

The first photo shows one of numerous Arundo clumps that previously were located along the lake shore. The second photo points in the opposite direction, from the former shore toward the lake. The expanse of white sand is not visible on Google Maps or the Figure 5 map, so must have been deposited during the past winter.

The third photo shows tall Arundo stalks near the delta, nourished by shallow groundwater, so now about 12 feet tall and growing rapidly. The challenge in these areas with shallow ground water is to spray the stalks before they grow to nearly 30 feet and start losing the lower leaves.

For comparison, the fourth photo shows a drought-stressed Arundo clump on the central upland that's dependent on rainfall only. New stalks growing among old dead stalks were 4 to 6 feet tall when sprayed during the past month, and would have grown to about 12 to 15 feet before turning dormant after a high-rainfall winter. This photo was taken to show the large tamarisk tree prior to release this summer of the tamarisk leaf beetle, an approved biocontrol agent, by Tom Dudley with UC Santa Barbara and the California Tamarisk Biocontrol Alliance.

From: "Bill Neill" <bgneill@earthlink.net>
To: "Wendy Katagi" <wkatagi@stillwatersci.com>
Subject: FW: July 11 progress report at Hansen Dam basin

From: Bill Neill <bgneill@earthlink.net>
Date: Tuesday, July 11, 2017 at 9:52 AM
To: Edward Belden <ebelden@nationalforests.org>, Robert Skillman <rskillman@lacorps.org>, Jason Giessow <jgiessow@cox.net>
Cc: Jason Casanova <cas@watershedhealth.org>, Carvel Bass <Carvel.H.Bass@usace.army.mil>
Subject: July 11 progress report at Hansen Dam basin

After returning from a 3-week vacation on June 18, I worked at Hansen Dam basin a total of 22.5 hours on 7 days between June 20 and July 10. My objectives were (1) follow-up treatments where I had previously missed some Arundo foliage or it had sprouted after initial treatment and (2) initial herbicide treatment in several areas where I had not worked previously.

Of the attached photos, photo 1 shows the cut-off line of herbicide treatment last fall at the far eastern end of the project area, where Arundo and scattered trees grow on open rocky terrain scoured by past floods. The view is southward, toward the bluffs and transmission towers overlooking Wentworth Street along the basin's south edge. To the west, or to the right in the photo, the rocky terrain merges into dense woodland with moist silty soil. After taking the photo

in early July, I sprayed green Arundo clumps pictured in the photo plus several more to the west into the woodland area, to the southern edge of the area burned on September 27 last year.

Nearby to photo 1, the green foliage near the center of photo 2 is a willow tree, not affected by the surrounding dead Arundo stalks, demonstrating that imazapyr herbicide does not harm adjacent or intermixed native vegetation if the application to Arundo foliage is careful and precise.

As an example of follow-up treaments, photo 3 shows three ages of post-fire resprouts in the burn area of September 27, at the basin's northeast corner. In the rear are brown stalks without leaves that were sprayed last fall. In the foreground, yellow Arundo foliage was sprayed in late April, having sprouted after winter rain. The light green foliage sprouted after late April, and was sprayed in late June, a week before the photo was taken.

During the past month, the largest area for initial treatment was the sub-basin south of the Aquatic Center, west of the lake, and northwest of the dam gates. This area burned in 2004, and over several years until 2008, I controlled most post-fire Arundo, Ailanthus and castor bean, but not entirely. The interior is now difficult to access due to abundant piles of timber from burnt dead trees that toppled several years after the fire.

Also I completed initial herbicide treatment in the dry Little Tujunga channel upstream of Foothill Blvd., to within 300 feet of the Middle Ranch road crossing, where spraying ended by contractors working downstream at Middle Ranch.

The Arundo map of last summer, titled "Figure 5 NFF Arundo control project: Hansen Dam, Fall 2016 work", shows 17.8 acres of Arundo, of which 8.4 acres were to be foliar sprayed and 9.4 acres were to be cut and chipped by ACS. I estimate that an additional 4 acres were not mapped due to inaccessibility and tree canopy cover. After 8 months of foliar spraying, assisted by LACC trail clearance and mower operation, I estimate that about two-thirds of the 22 acres has received initial and some follow-up herbicide treatment. The remaining untreated Arundo is difficult to access, so will require more trail clearance work, or is located near the Big Tujunga stream channel, which will become permissible to spray after the Santa Ana Sucker spawning season ends on August 1.

From: "Bill Neill" <bgneill@earthlink.net>
To: "Wendy Katagi" <wkatagi@stillwatersci.com>
Subject: FW: September update at Hansen Dam Arundo project

From: Bill Neill <bgneill@earthlink.net>
Date: Thursday, September 21, 2017 at 4:18 AM
To: Robert Skillman <rskillman@lacorps.org>, Edward Belden <ebelden@nationalforests.org>
Cc: Jason Casanova <cas@watershedhealth.org>, Jason Giessow <jgiessow@cox.net>, Carvel Bass <Carvel.H.Bass@usace.army.mil>
Subject: September update at Hansen Dam Arundo project

Although the CDFW permit allows herbicide treatment near water after July, I continued spraying upland Arundo clumps from late July to late August, mostly northeast of the dam gates, before the Arundo started to turn dormant from drought at summer end. This is where I'm interested in LACC crew assistance to access Arundo clumps intermixed with mulefat.

Since early September I have worked at the upstream end of the project area, on the wide, tree-filled floodplain of Big Tujunga Wash east of the Little Tujunga Wash confluence. The east-west-trending flood channel of Big Tujunga Wash is about 1000 feet wide, from north to south, and one mile long from the upstream property boundary to the Little Tujunga confluence. The wash is crossed by two high-voltage transmission lines that serve as geographical markers.

The eastern power line extends southwest from the intersection of the Foothill Freeway and Wheatland Ave., and forms the project area's eastern boundary with Los Angeles County's Big Tujunga Wash Mitigation Project. The western power line extends southeast from Orcas Park. The two power lines are one-half mile or about 2500 feet apart at the north bank and 1100 feet apart at the south bank next to Wentworth Street; thus the power lines and wash banks form a trapezoid with an area of about 50 acres. The northeast corner of the wash was burned a year ago by a 22-acre fire, and I sprayed post-fire Arundo resprouts last spring. The remaining woodland between the two power lines has a rhombus shape with an area of about 28 acres, where I have worked recently.

The other geographical markers are stream channels and equestrian trails. The flood plain is crossed from east to west by three stream channels with perennial flowing water: a lower volume channel with swampy areas near the north bank; a higher-volume, incised channel down the center; and another higher-volume, incised channel near the south bank. The center and southern channels were full of water last spring so could not be forded, but they are easily crossed now; and they merge into a single channel near the western power line.

Two east-west equestrian trails provide access to the dense woodland between the power lines. I refer to them as (1) the Orcas trail on the north side, on elevated dry ground between the northern and central stream channels; and (2) the Wentworth trail that closely follows the southern stream channel and crosses it four times. Midway between the power lines, the two east-west trail are connected by a third trail that I name the connector trail.

Before September, herbicide application was limited to the northern portion of the trapezoid — in the 22-acre burn area and along the unburned Orcas trail, where the LACC crew cleared access paths to Arundo clumps last spring. I completed initial herbicide treatments in August.

From September 8 to 16, I worked about 24 hours along the south stream channel and equestrian trail that's entered from the Wentworth/Wheatland intersection. This treatment area is a 6-acre riparian jungle, with dimensions of 800 feet by 300 feet, bisected by the stream channel. Arundo occupies between 1 and 2 acres, with large amalgamated clumps forming "walls" in places along the stream banks, but clumps away from the channel are smaller and less dense. This Arundo is mostly concealed from aerial view by tree canopy, so is not shown on the Figure 5 Arundo map.

Currently I'm working along the connector trail with access to the central stream channel, where Arundo clumps are again large and dense next to the stream channel, but less concealed by tree canopy.

The first attached photo shows an Arundo clump next to one of the stream crossings of the Wentworth trail.

The second photo shows a dry section of the Wentworth trail between stream crossings.

The third photo shows the intersection of the connector trail and Wentworth trail, with a "trail open" sign pointing to a recently cleared short tunnel or arch formed by Arundo in the distance.

The fourth photo shows an upland area crossed by the connector trail between the south and central stream channel.

The fifth photo shows the entrance of the connector trail to another recently cleared tunnel, about 100 feet long, near its intersection with the Orcas trail.

From: "Bill Neill" <bgneill@earthlink.net>
To: "Wendy Katagi" <wkatagi@stillwatersci.com>
Subject: FW: Arundo photos northeast of Hansen Dam gates

From: Bill Neill <bgneill@earthlink.net>
Date: Friday, November 17, 2017 at 8:32 AM

To: Edward Belden <ebelden@nationalforests.org>, Robert Skillman <rskillman@lacorps.org>
Cc: Jose Cabrera <jcabrera@lacorps.org>, Damian Morando <dmorando@lacorps.org>, Jason Giessow <jgiessow@cox.net>, Carvel Bass <Carvel.H.Bass@usace.army.mil>, Jason Casanova <cas@watershedhealth.org>
Subject: Arundo photos northeast of Hansen Dam gates

Yesterday I took several photos at Hansen Dam basin while spraying Arundo northeast of the dam gates that the LACC crew made accessible on November 6.

The first photo (14.19.41) shows a small dead Arundo clump located 200 feet northeast of the dam gates that I sprayed in October last year, soon after the project started, without damage to adjacent native trees.

The second and third photos were taken about 800 feet northeast of the dam gates, at the west end of a deep man-made ravine that joins the main outflow channel from the east. Here, one of the largest Arundo stands in the basin has dimensions of about 140 feet long and 50 feet wide, aligned with the main channel bank, with an area of about 1/6 acre. The second photo (12.56.43) shows part of the upland east side that was sprayed previously; my sprayer is hanging on a dead Ailanthus/Chinese tree of heaven that I treated by basal bark application of Pathfinder II. The third photo (13.01.24) shows the south edge of the Arundo stand, apparently massive here but elsewhere with passages and gaps that allow interior treatment by foliar spraying, as performed yesterday. Due to its large size, controlling this Arundo stand will require several years of herbicide treatment.

The fourth photo (15.39.07) was taken a quarter-mile northeast of the dam gates, in an upland area where the crew cut a tunnel through a "wall" of amalgamated Arundo clumps, so that I could spray the back side. I sprayed the accessible side of the Arundo (shown in the photo) last May, where the foliage has turned yellow. Prior to last winter, this upland Arundo was drought-stressed and appear to be mostly dead, but it was revived by above-average rainfall last winter. All of the gray dead stalks resulted from drought and old age, not from herbicide treatment.

The fifth and last photo (15.34.56) shows previously untreated upland Arundo near the fourth location but at slightly lower elevation, where soil moisture and native trees are more abundant.

From: Bill Neill <bgneill@earthlink.net>
Date: June 15, 2018 at 9:47:59 PM PDT
To: Wendy Katagi <wkatagi@stillwatersci.com>
Subject: FW: Burn areas near Orcas Park at Hansen Dam basin

From: Bill Neill <bgneill@earthlink.net>
Date: Monday, January 1, 2018 at 2:32 PM
To: Robert Skillman <rskillman@lacorps.org>, Edward Belden <ebelden@nationalforests.org>
Cc: Jason Casanova <cas@watershedhealth.org>, Jason Giessow <jgiessow@cox.net>
Subject: Burn areas near Orcas Park at Hansen Dam basin

For a New Year's morning outing, my wife and I drove across the entrance culvert to Middle Ranch, beyond which Osborne Street/Little Tujunga Canyon Road was closed, meaning that the upper Little Tujunga Wash project area was burned on December 5-6; then we walked east from Orcas Park to scout the burn areas of September 2016 and of last month.

East of Orcas Park, the wildfire of December 5-6 burned nearly all of Big Tujunga Wash that was not burned by the 22-acre fire of September 2016; but only small portions of the September 2016 fire area were burned again 4 weeks ago. In some cases, fire lines created for the September 2016 event became the edge of the recent burn area. So the September 2016 burn area is now an island of

green foliage of young mulefat and willow saplings, among dead standing white alder trunks and sparse dead Arundo stalks that I sprayed during the past year, and surrounded by the larger recent burn area.

Also on New Year's morning, while my wife remained at our parked car, I hiked south of Orcas Park to the 3-acre Arundo stand that I had previously sprayed only around the perimeter. Back in mid-November I had asked whether a mower could be employed to access this remaining large stand, and in response to Edward's question about other options, I answered: "The easiest option would be to hope for a wildfire, but we can't depend on that."

Fortuitously, only 3 weeks later, a once-in-a-generation fire did clear the understory biomass almost completely. As shown by the attached photo, the earliest sprouting Arundo stalks are mostly 8-10 inches tall, with a few as tall as 24 inches. By March, these early sprouters will be 4 to 8 feet tall and suitable for herbicide application, and numerous additional Arundo clumps will have resprouted that are now still dormant.

I don't know what financial resources remain available for the Hansen Dam project, but most of the remaining budget will be needed during the next 6 months, for controlling rapidly growing Arundo stalks in lowland areas with perennial moist soil. Due to the amount of spraying needed in a short time, I would welcome the assistance of one or two LACC crew managers or chainsaw operators who would use backpack sprayers under my supervision. On the other hand, in upland areas dependent on rainfall, where I sprayed nearly all green Arundo during 2017, follow-up herbicide treatments will not be needed until a future year with significant rainfall.

From: Bill Neill <bgneill@earthlink.net>
Date: June 15, 2018 at 9:48:43 PM PDT
To: Wendy Katagi <wkatagi@stillwatersci.com>
Subject: FW: Post-fire control of Arundo & tamarisk & perennial pepperweed at Hansen Dam basin

From: Bill Neill <bgneill@earthlink.net>
Date: Monday, February 5, 2018 at 6:06 PM
To: Edward Belden <ebelden@nationalforests.org>, Jason Casanova <cas@watershedhealth.org>, Robert Skillman <rskillman@lacorps.org>
Subject: Re: Post-fire control of Arundo & tamarisk & perennial pepperweed at Hansen Dam basin

On Jan. 27 I started spraying Arundo resprouts south of the equestrian center, in the largest stand that previously was impassable; and yesterday morning for 3 hours I started at the east end next to Wentworth Street. By yesterday the tallest stalks were about 6 feet, although most that I sprayed were 4 feet or shorter, with leaves opened. Many stalks are just emerging from the soil, and others will continue to sprout and grow throughout the spring months. Due to record warm temperatures, growth rates are faster than I expected, and I will need to work diligently during February to control the early sprouters. We'll figure out later which financial contributions cover which expenses.

Also on Jan. 27 I discovered an infestation of numerous small clumps east of the Little Tujunga Wash terminus that borders the burn area but did not burn, so any LACC crew time not spent on spraying post-fire resprouts can be allocated to trail cutting in this new area.

From: Edward Belden <ebelden@nationalforests.org>
Date: Monday, February 5, 2018 at 5:26 PM
To: Bill Neill <bgneill@earthlink.net>, Jason Casanova <cas@watershedhealth.org>
Cc: Robert Skillman <rskillman@lacorps.org>
Subject: RE: Post-fire control of Arundo & tamarisk & perennial pepperweed at Hansen Dam basin

Hey Cas and Bill,

Thanks so much for looking for some additional funding and finding some great opportunities. We are working on the grant right now with LACC that includes Bill's scope. I hope this will work through the system fast, but sometimes they are slower.

So funds to get the work started sooner might be very helpful, if we have additional funds in our agreement left over we should be able to just extend our grant to LACC and Bill.

Does that help?

From: Bill Neill [mailto:bgneill@earthlink.net]
Sent: Saturday, February 03, 2018 11:23 AM
To: Jason Casanova
Cc: Edward Belden; Robert Skillman
Subject: FW: Post-fire control of Arundo & tamarisk & perennial pepperweed at Hansen Dam basin

Cas – Thanks for your offer of support for post-fire work at Hansen Dam basin. Here's my response of Jan. 21 to the San Fernando Valley Audubon Society, which last week mailed a $1000 check to the CNPS chapter, which will cover my initial volunteer expenses.

From: Bill Neill <bgneill@earthlink.net>
Date: Sunday, January 21, 2018 at 10:19 AM
To: "hope_bird@outlook.com" <hope_bird@outlook.com>, Elisabeth Landis <betseylandis@sprintmail.com>, Michael obrien <mobla26@yahoo.com>, Snowdy Dodson <snowdy.dodson@csun.edu>, Halli Mason <hmason@sbcglobal.net>, Christian Kiillkkaa <christiankiillkkaa@gmail.com>, "Yuan,Henrietta" <henriettay@hotmail.com>, mary montes <mcmontes100@hotmail.com>, Jo Kitz <jkitz54@gmail.com>, Julie Clark De Blasio <clarkdeblasio@gmail.com>, Ileene Anderson <ieanderson@roadrunner.com>, Steve Hartman <NatureBase@aol.com>, Beth Olson <macbeth.olson@gmail.com>, Valarie Barsky <mrsbarsky@gmail.com>, "dhollombe@roadrunner.com" <dhollombe@roadrunner.com>
Cc: Muriel Kotin <akotin@earthlink.net>, Kris Ohlenkamp <kris.ohlenkamp@sbcglobal.net>,

<Mark.Osokow@sfvaudubon.org>
Subject: Re: Post-fire control of Arundo & tamarisk & perennial pepperweed at Hansen Dam basin

Thanks Mark. Last winter & spring, SFVAS contributed $1000 (via the CNPS chapter) toward invasive weed control work at Sepulveda Dam basin, mostly in the Wildlife Reserve, and the CNPS chapter contributed over $2000, to compensate for the cessation of financial support from the Sepulveda Basin Wildlife Consortium.

During the coming spring season, I expect that less work will be needed in the Sepulveda basin, because of progress last year and because California's drought has returned. If SFVAS could again contribute $1000 for the Hansen Dam project, that amount would be helpful, and any additional amount would be helpful.

My cost estimate for grant applications by the National Forest Foundation and Los Angeles Conservation Corps is $15,000 for 2018 and $5,000 for the following two years at Hansen Dam; but those amounts include labor at $40 per hour, and I don't expect support from SFVAS and CNPS to pay for more than supplies and travel, if grant applications are not successful.

During the 14 months of herbicide treatments that ended in early December, my expenses for herbicide totaled about $3,300; and I expect that another $1,600 for herbicide will be needed to complete the Arundo eradication. An additional several hundred dollars of herbicide will be needed for perennial pepperweed, but I believe that I can obtain some herbicide from City of L.A. Dept. Rec & Parks Forestry Division.

Of course, if the grant applications by NFF and LACC are successful, the local contributions will not be needed; but I will be surprised if grant funding can be secured before the post-fire Arundo starts growing rapidly.

From: "hope_bird@outlook.com" <hope_bird@outlook.com>
Date: Sunday, January 21, 2018 at 8:08 AM
To: Elisabeth Landis <betseylandis@sprintmail.com>, Michael obrien <mobla26@yahoo.com>, Snowdy Dodson <snowdy.dodson@csun.edu>, Halli Mason <hmason@sbcglobal.net>, Christian Kiillkkaa <christiankiillkkaa@gmail.com>, "Yuan,Henrietta" <henriettay@hotmail.com>, mary montes <mcmontes100@hotmail.com>, Jo Kitz <jkitz54@gmail.com>, Julie Clark De Blasio <clarkdeblasio@gmail.com>, Ileene Anderson <ieanderson@roadrunner.com>, Steve Hartman <NatureBase@aol.com>, Beth Olson <macbeth.olson@gmail.com>, Valarie Barsky <mrsbarsky@gmail.com>, "dhollombe@roadrunner.com" <dhollombe@roadrunner.com>, Bill Neill <bgneill@earthlink.net>
Cc: Muriel Kotin <akotin@earthlink.net>, Kris Ohlenkamp <kris.ohlenkamp@sbcglobal.net>, Mark Osokow <hopebird@lafn.org>, Jim Hartman <JHartman@acwm.lacounty.gov>, "Lopez, J." <J.Lopez@fire.lacounty.gov>, Ellen Mackey <emackey@mwdh2o.com>, Jason Casanova

<cas@watershedhealth.org>, "Kiernan, Conrad@DOT" <conrad.kiernan@dot.ca.gov>, Marty Friedman <marty.friedman@lacity.org>
Subject: RE: Post-fire control of Arundo & tamarisk & perennial pepperweed at Hansen Dam basin

Bill,

I am fairly certain SFVAS can help with funding, but I have no idea what a reasonable amount would consist of. We have a board meeting scheduled for tomorrow evening, and I will bring up your needs at the meeting. Of course, there is no guarantee that the board will approve a funding request.

It would be helpful if you could provide a cost estimate and the number of hours of work you expect to put in. While it is doubtful that SFVAS can completely fund your budget, between SFVAS and CNPS, we should be able to help. All I can do is present a proposal to the board.

Mark Osokow
Mark.Osokow@sfvaudubon.org

From: Betsey Landis <betseylandis@sprintmail.com>
Sent: Saturday, January 20, 2018 7:12:47 PM
To: Michael obrien; DODSON,SNOWDY D; Mason,Halli; Kiillkkaa,Christian; Yuan,Henrietta; Mary Montes; Kitz,Jo; Julie Clark De Blasio; Anderson,Ileene; Hartman,Steve; Beth Olson; Valarie Barsky; dhollombe@roadrunner.com; Bill Neill
Cc: Muriel Kotin; Kris Ohlenkamp; Mark Osokow; Jim Hartman; Lopez,J.; Ellen Mackey; Jason Casanova; Kiernan,Conrad@DOT; Marty Friedman
Subject: Re: Post-fire control of Arundo & tamarisk & perennial pepperweed at Hansen Dam basin

Yes, we should!
Betsey Landis

-----Original Message-----
From: Michael obrien
Sent: Jan 20, 2018 4:30 PM
To: "DODSON, SNOWDY D" , "Mason, Halli" , "Kiillkkaa, Christian" , "Yuan, Henrietta" , Mary Montes , "Kitz, Jo" , "Landis, Betsey" , Julie Clark De Blasio , "Anderson, Ileene" , "Hartman, Steve" , Beth Olson , Valarie Barsky , "dhollombe@roadrunner.com" , Bill Neill
Cc: Muriel Kotin , Kris Ohlenkamp , Mark Osokow , Jim Hartman , "Lopez, J." , Ellen Mackey , Jason Casanova , "Kiernan, Conrad@DOT" , Marty Friedman
Subject: Re: Post-fire control of Arundo & tamarisk & perennial pepperweed at Hansen Dam basin

the tour sounds great. we should contribute $$$ to continue Bill's work.

Michael O'Brien

On Saturday, January 20, 2018, 11:44:34 AM PST, Bill Neill <bgneill@earthlink.net> wrote:

During the 14 months from October 2016 to December 4, I worked about 370 hours at partly controlling about 30 net acres of Arundo at Hansen Dam basin. The project was funded by a grant to the National Forest Foundation (NFF) through the Los Angeles Conservation Corps (LACC), which also funded Arundo removal by other contractors in Big Tujunga Canyon and Little Tujunga Wash. My work at Hansen Dam basin involved spraying the green foliage of Arundo stalks, clumps, resprouts, and the periphery of large stands, plus supervising LACC crews that cut access trails.

The Creek Fire of December 5-6 burned nearly all vegetation southeast of a line extending from Orcas Park to the large barren gravel area between the lake and dam gates. Thus the fire burned all remaining untreated large stands in Big Tujunga Wash, plus large areas of tamarisk and perennial pepperweed on upland terrain southeast of the lake and northeast of the dam gates. Thus during the next year, before native vegetation grows tall and dead burned trees start to topple, I have a once-in-decades opportunity to control these infestations with minimal labor and costs.

Until last week, I presumed that the NFF project grant funding of last year would continue into 2018 and future years, because the regulatory permits (CA Dept. Fish & Wildlife) are valid for five years. Also, a NFF document that I received in October 2015 — "Tujunga Watershed *Arundo* Control Program and Riparian Restoration Statement of Work and Request for Information" — states that: "The five-year period of work will begin in 2015 and continue through 2019. It is anticipated that the largest portion of the biomass removal will take place during the first year and that subsequent years will only require herbicide treatment and minimal biomass removal." However, I presume that the project budget was completely spent during 2016 and 2017, because the grant administrator is now searching for additional funding.

Meanwhile, in untreated burn areas, Arundo stalks are starting emerge from the soil -- some have already grown to 3 feet and will be sufficiently tall and leafy for herbicide spraying in another month. The period of intense growth of Arundo, tamarisk and perennial pepperweed will extend from late February to June, then slow during summer months. Because I receive Social Security and pension income, I am committed to not wasting this post-fire opportunity during the next six month, if additional grant money is not secured; but I would welcome assistance from the LA/SMM CNPS chapter and/or SFV Audubon Society and/or other contributors for covering herbicide and travel expenses and perhaps minimum-wage labor if possible.

The CNPS chapter had a botanical tour of Big Tujunga Wash scheduled for December 9 that was cancelled due to the Dec. 5-6 wildfire. If any of you are interested in a post-fire tour of Hansen Dam basin, including some unburned areas, probably on Sunday, February 11, please respond and we'll arrange it.

Appendix D

Summary of Impacts to Threatened, Endangered, or Sensitive Species

Coastal California gnatcatcher (*Polioptila californica californica*)

The coastal California Gnatcatcher (*Polioptila californica californica*) is a small blue-gray member of the thrush family that is an obligate non-migratory resident of the coastal sage scrub environ from southern Ventura County into northern Baja Mexico. This environ is typified by low growing drought-deciduous shrubs, typically composed of communities dominated by coastal sage brush *(Artemisia californica)*, sages (*Salvia* ssp.) and buckwheat *(Erigonum fasiculatum)*. While the gnatcatcher has been found residing outside of the coastal sage scrub community, it is completely dependent on this environ for breeding. The density of gnatcatcher declines as the quality of the habitat declines, making this species an ideal indicator species. Historically, breeding territories of 2-14 acres are defended. In the mid-1960s significant population declines were attributed to extensive habitat loss and fragmentation driven by urbanization. This subspecies of gnatcatcher has been listed as an endangered species since 1993. Current population size is unknown and difficult to estimate since the presence of this species is patchy throughout its range. Most recent estimates indicate 1,324 breeding pairs over a range of 111,006 acres.

Through removal of Arundo, it is possible to re-establish suitable habitat for the coastal California gnatcatcher and slow the process of habitat degradation. By contributing to the frequent fire cycle, stands of Arundo play a role in the conversion of sage scrub habitat to invasive grassland habitat that is unsuitable for the coastal California gnatcatcher. Creating habitat for the coastal California gnatcatcher should occur wherever appropriate throughout the project area and should drive restoration design plans.

Atwood, J.L. 1993. California gnatcatchers and coastal sage scrub: The biological basis for endangered species listing. Pp. 149–169 in Keeley, J.E. (ed.). Interface Between Ecology and Land Development in California. Proceedings of the symposium convened. May 1–2, 1992, at Occidental College in Los Angeles. Southern California Academy of Sciences.

Winchell, C.S., and P.F. Doherty. 2008. Using California gnatcatcher to test underlying models of habitat conservation plans. Journal of Wildlife Management 72: 1322–1327.

U.S. Fish and Wildlife Service (USFWS). 2010. 5-Year Review coastal California gnatcatcher (Polioptila californica californica). https://ecos.fws.gov/docs/five_year_review/doc3571.pdf

Least Bell's vireo (*Vireo bellii pusillus*)

The least Bell's vireo (*Vireo bellii pusillus*) is a small migratory songbird that relies upon riparian habitat in central and southern California into Baja Mexico for reproduction. Historically incredibly abundant from Tehama County through northwestern Baja, least Bell's vireo has been listed as endangered by the State of California since 1970, and was listed on the federal Endangered Species Act in 1986. Habitat destruction, fragmentation, and degradation, in addition to nest parasitism by the brown-headed cowbird (*Molothrus ater*) have limited the range of this species significantly with the largest population in California existing within San Diego County. Since being listed in 1986 and the implementation of cowbird removal programs, least Bell's vireo has made a significant recovery and continues to recolonize previously extirpated areas. However, throughout Los Angeles County least Bell's vireo recovery is stymied by continual urbanization and habitat destruction. As such, there are no critical habitat designations within Los Angeles county for the least Bell's vireo.

Least Bell's vireo breed in riparian willow-cottonwood forests (*Salix* and *Populus* spp.), mulefat (*Baccharis salicifolia*) thickets, or oak (*Quercus* spp.) thickets. Nesting sites require dense

vegetation cover within 1-2 meters from the ground in which to place nests, and stratified canopy layers in which to forage. Additionally, early successional habitats are preferred for nesting. It is common for this species to rely on nearby scrub habitat for foraging purposes, specifically foraging on the berries of laurel sumac and elderberry. Males will typically defend territories of 0.5-7.5 acres. Current population estimates indicate that the least Bell's vireo meets the minimum viable population size, though full recovery of this species requires 14 viable metapopulations present throughout the historic range.

Arundo and other invasive species can quickly degrade riparian habitat once suitable for least Bell's vireo nesting. This coupled with other pressures mentioned above have made the recovery of this species within Los Angeles County especially challenging. Through the removal of Arundo, and when appropriate, restoration of native riparian plant communities, it is possible to recover habitat for least Bell's vireo. The least Bell's vireo has the potential to act as an umbrella species to many other endangered or threatened species that also inhabit riparian areas, such as Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis)* and the Southwestern Willow Flycatcher (*Empidonax traillii extimus*).

U.S. Fish and Wildlife Service (USFWS). 1998. Draft Recovery Plan for the Least Bell's Vireo (*Vireo bellii pusillus*). https://ecos.fws.gov/docs/recovery_plan/980506.pdf

U.S. Fish and Wildlife Service (USFWS). 2006. Least Bell's Vireo (*Vireo bellii pusillus*) 5-Year Review Summary and Evaluation. https://ecos.fws.gov/docs/five_year_review/doc781.pdf

Western Yellow-billed Cuckooo (*Coccyzus americanus occidentalis*)

The western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is a migratory bird that historically would nest in scattered patches of riparian area west of the Rocky Mountains, as well as parts of New Mexico, Colorado, and Arizona during the summer months. However, the range of this species has declined significantly, and is assumed to be extirpated from most of its range except for riparian areas in California and southwestern Nevada. This species was listed as threatened on the U.S. Endangered Species act as of 2014 due to extensive habitat loss and degradation.

Within California, the western yellow-billed cuckoo nests in deciduous riparian cottonwood (*Populus* spp.) and willow (*Salix* spp.) woodlands with dense understory. Nests typically occur within patches of riparian woodland ranging from 24-100 acres, with the nests being built in mature cottonwood or willows 1.5-13 meters from the ground. The availability of suitable nesting locations is generally rare due to degradation through flood control management practices, grazing, and spread of invasive species including tamarisk and Arundo. Many remaining areas of riparian woodlands are too small or heavily impacted by human activity to support nesting.

Currently, there are no critical habitat designations within the Los Angeles River watershed due to extensive degradation, fragmentation, and human activity. Protection and restoration of habitat for the western yellow-billed cuckoo within the upper Los Angeles River could have umbrella effects for several related species, including least Bell's vireo, Southwestern yellow flycatcher. As such, restoration activities that would restore willow and cottonwood riparian forests should be prioritized whenever possible.

U.S. Fish and Wildlife Service (USFWS). 2011. Coccyzus americanus. Species assessment and listing priority assignment form. USFWS, Region 8.

https://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/cp-fws-candidate-bi-coccyzus-americanus-2011-04.pdf

U.S. Fish and Wildlife Service (USFWS). 2014. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Western Distinct Population Segment of the YellowBilled Cuckoo. https://www.gpo.gov/fdsys/pkg/FR-2014-08-15/pdf/2014-19178.pdf

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

The southwestern willow flycatcher (*Empidonax traillii extimus*) historically breeds in riparian woodlands in the southwestern United States from western Texas, New Mexico, Arizona, and southern California. While the current range is similar to the historic range, the quantity of viable habitat has decreased significantly. As such, this species has been designated as endangered on the Endangered Species Act since 1995. In Los Angeles County this species was once common, though due to habitat destruction and degradation, the only remaining critical habitat exists within the Santa Clara River watershed.

Nesting occurs in proximity to surface water with patchy to dense coverage of willow (*Salix* spp.), mulefat (*Baccharis salicifolia*), cottonwood (*Populus* spp.), boxelder (*Acer negundo*), blackberry (*Rubus* spp.), and stinging nettle (*Urtica* spp.) Nest building occurs above dense understory foliage in trees or shrubs approximately 2 to 30 meters above ground. In riparian areas, nesting will not occur in narrow riparian strips smaller than 10 meters. Nests are clustered within patches ranging from 4.5 to 62.2 acres, with larger patches supporting as many as 10 nesting sites. While nesting has been known to occur in Russian olive (*Eleagnus angustifolia*) and tamarisk (*Tamarix ramosissima*), no documentation exists of nest sites within Arundo or Tree of Heaven (*Ailanthus altissima*).

Arundo removal combined with the restoration of willow and cottonwood forests with dense understories would provide much needed nesting habitat for the southwestern willow flycatcher. As such, whenever possible efforts to reestablish viable nesting habitat after Arundo removal should be made. Restoration of riparian willow and cottonwood habitat would also have benefits to related threatened species, such as the least Bell's vireo (*Vireo bellii pusillus*) western yellow-billed cuckoo (*Coccyzus americanus occidentalis*).

U.S. Fish and Wildlife Service (USFWS). 2002. Final Recovery Plan Southwestern Willow Flycatcher *(Empidonax traillii extimus)*.
https://ecos.fws.gov/docs/recovery_plans/2002/020830c.pdf

U.S. Fish and Wildlife Service (USFWS). 2013. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Southwestern Willow Flycatcher; Final Rule.
https://www.gpo.gov/fdsys/pkg/FR-2013-01-03/pdf/2012-30634.pdf

Southern Mountain Yellow-Legged Frog (*Rana muscosa*)

The southern mountain yellow-legged frog (*Rana muscosa*) is a medium amphibian that inhabits streams in the San Gabriel, San Jacinto, and San Bernardino Mountains. This species is currently limited to nine distinct populations within its range in southern California. The distinct populations of this species in southern California were listed as endangered under the Endangered Species Act in 2002. Historically this species occupied approximately 166 stream sites within the range described, but is now estimated to be extirpated from 99% of its historic range. While the critical habitat designation does not include areas within the upper Los Angeles River Watershed

that is included in this project, restoration of suitable habitat should be a priority for future recovery efforts in the area.

R. muscosa historically inhabits rocky shaded streams that are fed with cool waters with perennial flows from springs or snow melt at elevations of 370m to 2,290m. Both tadpoles and adults tend to occupy streams with shallow sloping banks that have a variety of substrate and pools in which to find refuge and forage within minimal aquatic vegetation. *R. muscosa* is rarely found more than 1m from a stream. The surrounding vegetation at lower elevations is typically composed of seep willow (*Baccharis viminea*), white alder (*Alnus rhombifolia*), big-cone spruce *(Pseudotsuga macrpcarpa*), and poplar (*Populus* spp.). To allow sufficient sunlight for thermoregulation, open canopy areas directly above the stream are preferred. Diverse terrestrial and aquatic insect species are necessary to provide sufficient foraging for adults, while tadpoles forage on detritus and algae on the stream bottom.

The populations of *R. muscosa* are threatened mainly by nonnative trout species that prey on tadpoles. Human activities that disrupt habitat such as hiking, swimming, dredging for gold, road construction, and illegal trash dumping, also negatively impact *R. muscosa*. Wildfires, which have been increasing in intensity and size in recent decades, severely impact available habitat for *R. muscosa* by eliminating surrounding vegetation which causes an increase in water temperature, altering stream channel morphology with heavy debris flows following a fire, and removal of refugia. Additionally, a severe lack of habitat connectivity threatens the survival of *R. muscosa* by limiting its ability for genetic exchange among the remaining 9 isolated populations.

The eradication of Arundo coupled with restoration of riparian species within the upper Los Angeles River would have multiple benefits for the recovery of *R. muscosa*. Since Arundo acts as a fire ladder, its removal would dampen potential impacts of fires that negatively impact habitat suitability. As Arundo reduces the availability of water within streams, its removal would result in greater flows as required by *R. muscosa*. Wherever suitable, removal of Arundo should be paired with restoration of native vegetation and creation of proper in-stream habitat for *R. muscosa* to aid in habitat connectivity and recovery efforts.

U.S. Fish and Wildlife Service (USFWS). 2012. Mountain Yellow-Legged Frog (Rana muscosa) Southern California Distinct Population Segment 5-year Review: Summary and Evaluation. https://ecos.fws.gov/docs/five_year_review/doc4001.pdf

U.S. Fish and Wildlife Service (USFWS). 2006. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Southern California Distinct Population Segment of the Mountain Yellow-Legged Frog (Rana muscosa); Final Rule. https://www.gpo.gov/fdsys/pkg/FR-2006-09-14/pdf/06-7578.pdf

Arroyo toad (*Anaxyrus californicus*)

The arroyo toad (*Anaxyrus californicus*) is a small toad historically found throughout coastal drainages in Monterey County into Baja California, Mexico. However, due to degradation of habitat conditions associated with urbanization, the arroyo toad is currently almost exclusively found in isolated populations at the headwaters of streams. It is estimated that the arroyo toad has been extirpated from 75% of its historic range. Portions of the upper Los Angeles River basin have been designated as critical habitat for the arroyo toad. Having originally been listed as endangered on the Endangered Species Act as a subspecies of the southwestern toad (*Bufo californicus microscaphus*) in 1994, a re-evaluation of the taxonomy classified the arroyo toad as

its own species (*Bufo californicus*) in 2001 while remaining endangered. In 2009 the classification was changed to its current species name, *Anaxyrus californicus*.

During breeding season, the arroyo toad prefers large river systems characterized by large, slow moving and meandering channels with soft silt or sand bottoms. Eggs are typically laid in shallow sandy pools bordered by gravel flood terraces. Outside of breeding season the arroyo toad is mostly terrestrial, residing in a variety of plant communities, including sycamore-cottonwood woodlands, oak woodlands, chaparral, coastal sage scrub, and grassland communities. Areas with sandy soil, or soil that readily crumbles is preferred for burrowing in order to seek shelter.

The main threats to the arroyo toad include habitat degradation caused by dam operations, urbanization, and invasive nonnative plants. The removal of Arundo is an important step in the recovery of appropriate habitat for the arroyo toad. Since Arundo spreads quickly and dramatically alters the water available in-stream, it can dramatically degrade suitable riparian habitat. Whenever possible, areas suitable for arroyo toad habitat should be reestablished through the removal of Arundo and recovery of native riparian species in both the riparian area and adjacent communities.

U.S. Fish and Wildlife Service (USFWS). 2011. Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Arroyo Toad; Final Rule. https://www.gpo.gov/fdsys/pkg/FR-2011-02-09/pdf/2011-1703.pdf

U.S. Fish and Wildlife Service (USFWS). 2009. Arroyo Toad *(Bufo californicus (=microscaphus))* 5-Year Review: Summary and Evaluation. https://ecos.fws.gov/docs/five_year_review/doc2592.pdf

Arroyo chub (*Gila orcutti*)

The arroyo chub (*Gila orcutti*) is a small fish native to few streams and drainages in southern California, with historic distributions including Los Angeles, San Gabriel, San Luis Rey, Santa Ana, and Santa Margarita Rivers, as well as Malibu and San Juan Creeks. Due to urbanization causing degradation of stream conditions, competition or predation by nonnative species, wildfires, and dams, this species is now only abundant in Malibu, De Luz, Trabuca, and Big Tujunga Creeks, as well as the upper Santa Margarita River and San Gabriel River above Cogswell dam. While not currently listed as threatened or endangered by the State of California or the Endangered Species Act, the arroyo chub is a species of special concern with a high risk of becoming extinct within its natural range per the California Department of Fish and Wildlife.

The arroyo chub is typically found in slow moving streams of gradients less than 2.5% or pools, both with depths greater than 40cm that have a sandy or muddy bottom. The arroyo chub is well adapted to the temperature swings common in small streams of southern California, being tolerant of temperatures ranging from 10-28°C. Tending to prefer areas with emergent aquatic vegetation, the arroyo chub mainly feeds on algae and some aquatic invertebrates.

Much of the arroyo chub's native range throughout Los Angeles has been heavily impacted by urbanization and pressures associated with human presence. Much of the Los Angeles River has been channelized and dammed, causing a reduction of available suitable habitat and fragmentation of remaining habitat. Streams within the Los Angeles National Forest are heavily used for recreational purposes, including swimming and hiking, activities that alter and degrade stream conditions. Fires with large burn areas, followed by heavy rain events that cause large amounts of sediment and debris flows threaten the remaining habitat for the arroyo chub.

Predation by nonnative fish pose the greatest threat to arroyo chub, as many introduced fish species prey upon the arroyo chub at all life stages.

Arundo removal within the upper Los Angeles River presents an opportunity to recover valuable habitat for the arroyo chub and prevent future habitat degradation. Removal of Arundo will allow for greater water availability in-stream, which also has the potential to cause changes in the hydrology that will be suitable for arroyo chub. Additionally, as Arundo acts as a fire ladder, with its removal the intensity of fires with large burns areas will be diminished, leading to a lower probability of having debris flows that disturb habitat areas for the arroyo chub.

California Department of Fish and Wildlife (CDFW). 2015. Fish Species of Special Concern Accounts, 3rd Edition. Arroyo Chub *Gila orcutti*. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=104270&inline

Western brook lamprey (*Lamptera richardsoni*)

The western brook lamprey (*Lamptera richardsoni*) is a small, non-predatory lamprey species with historical distribution in undisturbed watersheds throughout coastal streams from southeastern Alaska through California. California Department of Fish and Wildlife (CDFW) lists *L. richardsoni* as a species of special concern at moderate concern status. In 2003, a petition to list *L. richardsoni* on the Endangered Species Act was found to be not substantial largely due to a lack in accurate scientific data. Populations existing within California are isolated, small, and likely declining. Habitat loss, dams and other passage barriers, as well as pollutants associated with urbanization are the main threats to *L. richardsoni*. Limited data on populations in California exist, but this species has been largely extirpated from the Los Angeles River watershed due to its highly degraded and altered state.

Similar to salmonid species, *L. richardsoni* prefer cool clear streams with low flow velocity and clean, small gravel. Ample opportunities to seek refuge under large rocks, logs, or similar structures are also required. Spawning typically occurs in upstream narrow, shallow, low flow areas with fine sediments that are not regularly scoured by flooding events. Nests contain large amounts of eggs that serve as a potential food source for salmonid species. Once hatched, juveniles (ammocoetes) migrate downstream, anchoring into the stream bed to filter feed on algae and diatoms. Transition into the adult stage occurs after 3-4 years, after which feeding ceases and migration upstream to spawn begins.

Alteration of stream hydrology due to channelization, invasive species, and large debris flows following fires has resulted in the extirpation of *L. richardsoni* from much of its historical range in southern California. Removal of Arundo from streams has multiple potential benefits for the restoration of *L. richardsoni* habitat. Arundo alters stream hydrology by removing large volumes of water from streams, potentially causing the transition of a once suitable stream area into an area no longer suitable for foraging or spawning. Additionally, the presence of Arundo in streams removes potential areas of refuge for *L. richardsoni* by outcompeting surrounding native vegetation that supply trunks and logs to the instream habitat. By acting as a fire ladder, Arundo further promotes the degradation of *L. richardsoni* habitat by adding to the fuel load of fires, leading to larger burn areas that feed debris flows in post-fire rain events. Where suitable, steps to restore habitat for *L. richardsoni* should be taken. In restoring habitat for this species, it is likely to also have positive effects on the abundance of endangered salmonid species as well, due to similarity in habitat preferences and by providing a food source to salmonid species at *L. richardsoni* nesting sites.

California Department of Fish and Wildlife (CDFW). 2015. Fish Species of Special Concern Accounts, 3rd Edition. Western Brook Lamprey *Lamptera richardsoni*. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=104386&inline

Santa Ana Speckled Dace (*Rhinichthys osculus* ssp.)

The Santa Ana speckled dace (*Rhinicthys osculus* ssp.) is a phylogenetically distinct subspecies of speckled dace historically ranging throughout streams and lakes in the Los Angeles basin. California Department of Fish and Wildlife (CDFW) include this species as a species of special concern with a critical concern ranking. It is estimated that due to drastic habitat loss and fragmentation it is likely this species will be extinct within 50 years. Santa Ana speckled dace are not listed by the U.S. Fish and Wildlife Service on the Endangered Species Act, however. While estimates of remaining populations have not been documented, populations have been extirpated from two of the five streams in the Los Angeles basin, and only eight small, isolated populations are estimated to remain. Stable populations are known to exist in Big Tujunga Creek, parts of the San Gabriel and Santa Ana River, and Lytle Creek.

Santa Ana speckled dace are usually located in perennial streams in which the temperature remains below 20°C. The preferred stream habitat appears to be highly variable. However, populations appear to typically reside in low gradient shallow riffles with depths of 15-30cm having gravel and cobble substrate. Spawning occurs within lakes or on the edges of riffles within inlets during periods of rising water temperature or high flow events. Foraging varies with prey availability, but consists mainly of small benthic invertebrates.

The main threats to this species are habitat loss, degradation, and fragmentation. Nearly all of the streams historically occupied by Santa Ana speckled dace have been diverted or dammed, resulting in drastic changes to stream flows and inhibition of upstream migration. Pollution from surrounding urban area runoff degrade the water quality of remaining habitat areas. Increasing intensity and frequency of fires result in debris flows that destroy Santa Ana speckled dace habitat. Introduced aquatic species such as Brown trout (*Salmo trutta*), stocked rainbow trout (*Oncorhynchus mykiss*), bass (*Micropterus* spp.), bullfrogs (*Lithobates catesbeiana*) and others are known to prey on Santa Ana speckled dace, depleting its already dangerously low populations. Stands of Arundo alter stream flows, lower dissolved oxygen, and increase pH and ammonia levels resulting in habitat loss. Removal of Arundo in combination with other invasive species control measures creates an opportunity to restore suitable habitat for the critically endangered Santa Ana speckled dace. Steps should be taken, wherever appropriate, to combine Arundo removal with the removal of other invasive species that threaten the Santa Ana speckled dace. Further actions to reestablish stream characteristics to support Santa Ana speckled dace after Arundo removal are crucial for the recovery of this species.

California Department of Fish and Wildlife (CDFW). 2015. Fish Species of Special Concern Accounts, 3rd Edition. Santa Ana Speckled Dace *Rhinicthys osculus ssp*. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=104372&inline

Unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*)

The unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) is a small scaleless fish historically inhabiting low gradient stretches of the Los Angeles, San Gabriel, and Santa Clara Rivers. Having been extirpated from the majority of its range, the unarmored threespine stickleback (UTS) has been listed as endangered on the Endangered Species Act by the United States Fish and Wildlife Service since 1970. No designation of critical habitat for UTS exists,

however. This species currently has extremely limited distribution in a few tributaries of the Santa Clara River, though these populations are extremely fragile due to habitat degradation caused by urbanization and invasive nonnative plant species. Current population counts are unknown, though remaining populations are thought to be small and extremely isolated.

The UTS tend to be found in pond areas with slow currents in streams with ample aquatic vegetation (*Cladophora* spp. and *Rorippa* spp.) and depths of 40cm or greater. Headwater streams that form pools with slow, constant flows during the dry season and are disconnected from lower coastal areas except during the rainy season are ideal for UTS. Spawning can occur year-round, though most spawning occurs in spring, summer, and early fall. UTS feed on small invertebrate species, including insects, crustaceans, and snails.

Habitat destruction and degradation are the main threats to the UTS. Wildfires resulting in large debris flows alter stream habitat, usually resulting in a loss of habitat suitable for UTS. Urbanization and associated pollution and habitat degradation also threaten UTS habitat. The loss of available in-stream water due to high transpiration rates of Arundo threatens UTS habitat. As such, removal of Arundo in the upper Los Angeles River provides an important opportunity to reclaim habitat that may be suitable for UTS reintroduction and recovery efforts. Additionally, as Arundo increases the intensity of fires resulting in greater debris flows, its removal could alleviate future negative impacts of debris flows following large fires.

U.S. Fish and Wildlife Service (USFWS). 2009. Unarmored Threespine Stickleback *(Gasterosteus aculeatus williamsoni)* 5-Year Review: Summary and Evaluation. Available at: https://ecos.fws.gov/docs/five_year_review/doc2629.pdf

U.S. Fish and Wildlife Service (USFWS). 1985. Revised Unarmored Threespine Stickleback Recovery Plan. Available at: https://ecos.fws.gov/docs/recovery_plan/Revised%20UTS%20RP.pdf

Southern California Steelhead (*Oncorhynchus mykiss*)

The southern California steelhead (SCS) is a distinct population of steelhead recognized as a threatened species in the Endangered Species Act since 1997. Being anadromous, adults spawn in freshwaters, and juveniles migrate to coastal waters to complete their life cycle. It is estimated that SCS populations have declined by more than 90% of historic levels. Flood control programs and urbanization pose the largest threats to the recovery of the remaining SCS populations resulting in degradation or loss of proper stream conditions required for migration and spawning. Due to continued loss of freshwater habitat, SCS have largely been extirpated from the majority of their historical range in southern California. The Los Angeles River is not currently designated as critical habitat for SCS; historically the Los Angeles River hosted SCS runs until pressures associated with urbanization and flood control measures made passage to upstream spawning habitats impossible. Stream and river restoration efforts for SCS have the potential to benefit many other species, making the southern California steelhead an umbrella species. Aquatic and amphibious species expected to also benefit from steelhead recovery efforts include the arroyo toad (*Anaxyrus californicus*), unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*), Santa Ana speckled dace (*Rhinicthys osculus* ssp.), western brook lamprey (*Lamptera richardsoni*), arroyo chub (*Gila orcutti*), southern mountain yellow-legged frog (*Rana muscosa*). Positive ripple effects of stream restoration activities are also likely for endangered terrestrial species, such as southwestern willow flycatcher (*Empidonax traillii extimus*), least Bell's vireo (*Vireo bellii pusillus*), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), among many others.

Southern California steelhead are the only native anadromous species in southern California. Historically this species entered coastal rivers and streams from Point Sal through Mexico, including the Los Angeles River, following heavy rain events in the winter and spring that resulted in high enough flows to allow passage upstream to spawning and rearing habitats. Spawning occurs in gravel beds up to hundreds of miles upstream from coastal waters. The rate of hatching, and metabolism of the resulting fry, is tightly linked to water temperature, with warmer waters resulting in a shorter development time and greater metabolic requirements. Juvenile SCS spend one to three years in freshwater rearing habitats before returning to the ocean. However, SCS exhibit variable life history strategies, and it is not uncommon for some individuals to send their entire life cycle in fresh water. These individuals are typically known as rainbow trout. If ample flows are not available, SCS will remain in pools upstream until passage to the ocean becomes available. Female SCS may migrate between spawning grounds and the ocean several times throughout their lifetimes.

The main threat to SCS is a loss of passage to historic spawning habitats due to stream modifications that result in barriers to migration, decreased flow resulting in habitat fragmentation, or increased water temperatures outside the suitable range for SCS. In watersheds in which migration can occur many streams are heavily polluted from urban runoff, or the surrounding native vegetation that would have shaded the stream and kept it cool has been removed. The giant reed, Arundo, contributes to the degradation of SCS habitat by displacing native riparian vegetation resulting in increased water temperatures, as well as causing a reduction of in-stream flows due to its high levels of transpiration. While many factors need to be addressed in order to recover and restore habitat for SCS, removal of Arundo and restoration with native riparian plant communities is an important step in this process.

National Marine Fisheries Service (NMFS). 2012. Southern California Steelhead Recovery Plan. Southwest Region, Protected Resources Division, Long Beach, California. Available at: http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/south_central_southern_california/final_southern_california_steelhead_recovery_plan_volume_1.pdf

National Oceanic and Atmospheric Association (NOAA). 2005. Endangered and Threatened Species; Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California; Final Rule. Available at: https://www.gpo.gov/fdsys/pkg/FR-2005-09-02/pdf/05-16389.pdf

Nevin's barberry (*Berberis nevinii*)

Nevin's barberry (*Berberis nevinii*) is an evergreen shrub with gray-green leaves that reaches heights of 1 to 4 meters. *B. nevinii* is historically a very rare plant, with estimates of 30 native occurrences throughout Los Angeles, San Bernardino, and Riverside Counties. Since being listed as endangered by U.S. Fish and Wildlife Service in the Endangered Species Act in 1998, there are estimated to be 14 natural native occurrences, totaling fewer than 200 individuals. *B. nevinii* was historically present in the San Fernando Valley, but has been locally extirpated. The nonnative individuals in San Francisquito Canyon are believed to be the only remaining descendants of the extirpated San Fernando Valley population.

B. nevinii grows in coarse or sandy soils between 300-650m elevation within alluvial scrub, chamise chaparral, coastal sage scrub, oak woodland, riparian scrub, or riparian woodland communities. Being a long-lived species, *B. nevinii* typically lives 50 years or more. Reproduction of fertile seed is sporadic, and generally not much is known about this species' life

history. While *B. nevinii* is rhizomatous, it is not known to reproduce through vegetative spreading. The fruits of *B. nevinii* are reliant on animal dispersal for germination. *B. nevinii* is fire resistant, but requires fire-free intervals for germination.

The main threats to *B. nevinii* recovery include pressures associated with urbanization and an increase in the frequency of fires within its critical habitat. Arundo eradication within the upper Los Angeles River has the potential to alleviate the intensity of fires, as Arundo acts as a fire ladder. This would *benefit B. nevinii* by potentially extending the fire interval period, allowing for greater reproductive potential. Furthermore, Arundo stands may be occupying sites suitable to *B. nevinii*, and populations may reestablish once Arundo has been removed.

U.S. Fish and Wildlife Service (USFWS). 2009. Nevin's Barberry *(Berberri nevinii)* 5-Year Review: Summary and Evaluation. Available at: https://ecos.fws.gov/docs/five_year_review/doc2557.pdf

U.S. Fish and Wildlife Service (USFWS). 2008. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for *Berberis nevinii* (Nevin's barberry); Final Rule. Available at: https://www.gpo.gov/fdsys/pkg/FR-2008-02-13/pdf/08-523.pdf#page=2

Southern tarplant (*Centromadia parryi* ssp. *australis*)

The southern tarplant (*Centromadia parryi* ssp. *australis*) is a small annual plant within the daisy family, and is listed as rare, threatened, or endangered by the California Native Plant Society. Historically found throughout southern California and northern Baja, Mexico, the southern tarplant usually inhabits highly disturbed areas within fresh and saltwater marshes or vernal pools. The main threats this species include habitat loss, degradation, and fragmentation. Arundo removal projects would benefit the southern tar plant populations as Arundo may compete with this species directly.

Bruce G. Baldwin 2012, Centromadia parryi subsp. australis, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=79524, accessed on June 23, 2018.

Calflora: Information on California plants for education, research and conservation, with data contributed by public and private institutions and individuals, including the Consortium of California Herbaria. [web application]. 2018. Berkeley, California: The Calflora Database [a non-profit organization]. Available at: http://www.calflora.org/

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 23 June 2018].

San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*)

The San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*) was assumed to be extinct until a population of 23,000 plants was discovered in the Ahmanson Ranch area of the San Fernando Valley in 1999. Upon its rediscovery, the San Fernando Valley spineflower (SFVS) was listed as rare, threatened, or endangered by the California Native Plant Society. Also upon its discovery, the U.S. Fish and Wildlife Service (USFWS) was petitioned to include SFVS as an endangered species under the Endangered Species Act. USFWS has since withdrawn their 2016 proposed rule to list SFVS as a threatened species. Historically SFVS inhabited alluvial scrub and

open grasslands at 14 locations throughout Ventura, Los Angeles, and Orange Counties. Currently, SFVS is extirpated from all historical locations except two: Laskey Mesa in Ventura County on land owned by Santa Monica Mountains Conservancy and the Mountain Recreation Conservation Authority, and a population in Santa Clarita, Los Angeles in the Newhall Ranch development area.

SFVS habitat includes washes and sandy areas throughout the foothills of the San Gabriel and Santa Ana Mountains. Typical plant communities in which SFVS is found include alluvial scrub and grassland. Preferring open areas with loam or silty clay loam soils, SFVS tends to be found in areas unsuitable for other scrub species. SFVS uses a generalist pollination strategy, and dispersal and germination of seeds is associated with several ant and burrowing mammal species.

Urbanization throughout southern California resulted in the extirpation of SFVS from most of its historical range. Recently, large portions of the population at Newhall Ranch were lost to the 2017 Rye Fire. Remaining populations are also at risk of being lost to fire. Arundo removal in the upper Los Angeles River area has the potential to buffer SFVS from fires, as Arundo contributes to the fire cycle by acting as a fire ladder. Furthermore, in some areas Arundo may outcompete SFVS in areas it would otherwise be able to inhabit. As such, Arundo removal is a key step in the recovery of SFVS.

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Available at: http://www.rareplants.cnps.org/detail/472.html

Glenn Lukos Associates, Inc. and Sapphos Environmental, Inc. 2000. Biology of the San Fernando Valley Spineflower, Ahmanson Ranch, Ventura County, California. Available at: https://nrm.dfg.ca.gov/FileHandler.ashx%3FDocumentID%3D11201&sa=U&ved=0ahUKEwjg1-Pb--rbAhXCHDQIHYVMBeQQFggEMAA&client=internal-uds-cse&cx=001779225245372747843:3y4rnp6j9ny&usg=AOvVaw2DlXRaekz0htcvUl-oGdoz

U.S. Fish and Wildlife Service (USFWS). 2018. Withdrawal of the Proposed Rule To List *Chorizanthe parryi* var. *fernandina* (San Fernando Valley Spineflower); Proposed rule; withdrawal. Available at: https://www.gpo.gov/fdsys/pkg/FR-2018-03-15/pdf/2018-05081.pdf

U.S. Fish and Wildlife Service (USFWS). 2016. Endangered and Threatened Wildlife and Plants: Threatened Species Status for *Chorizanthe parryi* var. *fernandina* (San Fernando Valley Spineflower). Available at: https://www.regulations.gov/document?D=FWS-R8-ES-2016-0078-0001

Slender-horned spineflower (*Dodecahema leptoceras*)

The slender-horned spineflower (*Dodecahma leptoceras*) is a small annual member of the buckwheat family typically found in alluvial benches that only rarely flood. The U.S. Fish and Wildlife Service listed the slender-horned spine flower (SHS) as endangered in 1987 due to urbanization and flood control measures. The California Native Plant Society lists SHS as rare or endangered. As of 2010, a total of 20 occurrences have been identified. The historic range of this species include sandy alluvial fans in the mountain foothills from northern Los Angeles County into the eastern portion of San Bernardino County and the southwestern portion of Riverside County from 200m to 700m. In Los Angeles County, extant populations have been identified in Big Tujunga Wash and Bee Canyon.

SHS prefers sandy benches of alluvial fan scrub habitat, and is usually associated with the scale broom scrub plant community. SHS has also been found in the alluvial fan area of braided streams. Germination occurs in February, and increased germination rates have been observed following a disturbance event such as a sheet flow or fire. Annual seed production varies greatly in response to environmental conditions, with greater seed production occurring in cool and rainy years.

Altered flood regimes and urbanization pose the greatest threat to SHS. Flood control structures that alter the flood channel degrade and fragment remaining alluvial scrub areas in Los Angeles County, much of which has already been lost to development. Presence of Arundo in streams exacerbates the already altered hydrology; the high transpiration rates of Arundo decrease the water available and lower flow rates. Removal of Arundo from the upper Los Angeles River and restoration of associated alluvial scrub habitat where appropriate will provide an important opportunity to recover habitat for SHS.

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Available at: http://www.rareplants.cnps.org/detail/447.html

U.S. Fish and Wildlife Service (USFWS). 2010. *Dodecahema leptoceras* (slender-horned spineflower) 5-Year Review: Summary and Evaluation. Available at: https://ecos.fws.gov/docs/five_year_review/doc3622.pdf

U.S. Fish and Wildlife Service (USFWS). 1987. Endangered and Threatened Wildlife and Plants; Endangered Status for *Eriastium densifloium* ssp. *sanctorum* (Santa Ana River wooly star) and *Centrostegia leptoceras* (slender-horned spineflower). Available at: https://ecos.fws.gov/docs/federal_register/fr1332.pdf

Greata's aster (*Symphyotrichum greatae*)

Greata's aster (*Symphyotrichum greatae*) is a small perennial rhizomatous herb endemic to California. Limited information is available on the range, population, and biology of this species, though it is listed as a rare or endangered plant by the California Native Plant Society. Greata's aster is usually found within canyons in which soil moisture is ample at elevations ranging from 300m-2000m. The current range of this species appears to be limited to protected areas within the San Gabriel, Santa Susana, and Verdugo Mountains. This species is threatened by recreational activities that disturb, destroy, or degrade its habitat, in addition to competition with non-native invasive species. Removal of Arundo from the upper Los Angeles River provides an important opportunity to reestablish Great's aster throughout the Los Angeles River basin, as competition with Arundo, and the habitat degradation associated with Arundo stands is likely a factor contributing to the limited range of this species in the Upper Los Angeles River Watershed.

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Available at: http://www.rareplants.cnps.org/detail/290.html

Allen, Geraldine. 2012. *Symphyotrichum greatae* in Jepson Flora Project (eds.) Jepson eFlora. Available at: http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=80308

Salt Spring Checkerbloom (*Sidalcea neomexicana*)

The Salt Spring Checkerbloom is a small perennial herb historically found throughout Southern California, parts of New Mexico, Arizona, and southwest Colorado. Within California, the Salt Spring Checkerbloom is found growing in alkaline springs and marshes within the Santa Susana, Verdugo, and San Gabriel Mountains below 1500m. Little is known of the historical range of this species, however the California Native Plant Society lists the Salt Spring Checkerbloom as rare or endangered. It is unclear what threats pose the greatest danger to this species in California, though presence of Arundo in the upper Los Angeles River is likely limiting its range through direct competition and/or degradation of habitat. Eradication of Arundo from the Upper Los Angeles Watershed and restoration of native plant species would potentially provide an opportunity for the expansion of Salt Spring Checkerbloom populations.

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Available at: http://www.rareplants.cnps.org/detail/1778.html

Hill, Steven E. 2012. *Sidalcea neomexicana* in Jepson Flora Project (eds.) Jepson eFlora. Available at: http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=44429

Davidson's bush-mallow (*Malacothamnus davidsonii*)

Davidson's bush-mallow (*Malacothamnus davidsonii*) is a perennial deciduous shrub found in dry washes or coastal sage scrub areas from San Francisco to the San Fernando Valley. Though not recognized as endangered by state or federal agencies, the California Native Plant Society lists this plant as rare or endangered, with remaining populations classified as imperiled. Davidson's bush-mallow is mainly threatened by urbanization in Los Angeles County and associated degradation and loss of habitat. The presence of Arundo within the Upper Los Angeles River Watershed may also be a contributing factor, as it is unlikely Davidson's bush-mallow would be able to outcompete the spread of this nonnative invasive species. Arundo eradication and reestablishment of coastal sage scrub communities provides an opportunity to restore suitable habitat for Davidson's bush-mallow and recover its population.

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Available at: http://www.rareplants.cnps.org/detail/1062.html

Slotta, Tracey. 2012. *Malacothamnus davidsonii*, in Jepson Flora Project (eds.) Jepson eFlora. Available at: http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=32515

Santa Ana Sucker (placeholder)