# Final Report:

# Steelhead Creek Draft Horse Stream Channel Cleanup Project

Prepared for:

Sacramento Regional San


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Cascades on Steelhead Creek as seen from Northgate bridge. “Island” in lower left is non-native, water primrose growing on shopping cart. Shrubbery in left foreground is invasive scarlet wisteria, removed during Project.

*“We abuse land and its waters because we regard is as a commodity belonging to us. When we see the land as a community to which we belong, we may begin to use it with love and respect.”*

*~Aldo Leopold, A Sand County Almanac*

*“I have restored well over 100 streams across the country but I have never seen an urban creek that has been so badly abused as Steelhead yet has so much habitat potential.”*

*~Steve Zembsch, Stream restoration specialist, 2018*

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# EXECUTIVE SUMMARY

Steelhead Creek, in the City of Sacramento, is an urban perennial stream that traverses the American River Parkway, flows parallel to Garden Highway, and empties into the Sacramento River at Discovery Park (Appx. I). The stream supports small but important runs of steelhead and Chinook salmon which spawn in its upper tributaries. Many other native animals such as beaver, otter, raccoon, skunk, and coyote live within this riparian corridor.

Years of neglect, illegal dumping, and recently, uncontrolled homeless camping have caused tons of solid and hazardous waste to be deposited in the channel, damaging its ability to sustain life there (Photo 1, Video 1). Large debris, particularly shopping carts, form islands where floating debris and water primrose accrete on them, obstructing fish passage and reducing water conveyance capacity. Other debris, like mattresses, tires, and textiles, armor the channel bottom, impeding access to burrowing organisms, and creating an anoxic dead zone in which no organisms survive.

Invasive non-native scarlet wisteria trees line the banks, trapping debris and displacing native vegetation (Photo 2). A recent proliferation of water primrose has grown into dense mats, in places completely blocking the channel, impeding fish migration, trapping debris, and preventing light from penetrating the water (Photo 3).

This project, funded by a Confluence Grant through Sacramento Regional San, in partnership with Save the American River Association (SARA) and the County of Sacramento Regional Parks, experimented with using a team of draft horses to remove solid waste and primrose from the stream channel, and wisteria from its banks. The work lasted 13 days, extending 0.7 miles from the Northgate to the W. El Camino bridge.

At three “metric sites” we thoroughly removed debris and inventoried it to identify its probable source and age, and weighed and calculated its volume to ascertain the condition of the creek. We removed 43,319 lbs of debris from the channel and from a number of abandoned camps nearby. We removed 349 wisteria plants and 11,748 lbs of primrose from the channel waterway.

Despite several setbacks, the Project proved that horses can access parts of the stream that machinery could not; can pull loads over 1,000 lbs, much larger than can be done by hand

and much more quickly; and they can readily drag heavy loads to disposal sites. Using horses, primrose can be extracted from the channel 500 lbs at a time—well beyond what can be done by hand— and mature wisteria can be pulled by its roots in a fraction of the time than can be done manually.

Future efforts to continue cleaning the channel and abating the invasive vegetation should consider a combination of horses and powered winches.

# 1.0 INTRODUCTION

## 1.1 Background

Millions of wild salmon and steelhead once inhabited the rivers and streams in the foothills of California's Central Valley, but by the 1990s, three of the valley's salmon and steelhead species were close to extinction and listed under the federal Endangered Species Act (ESA): Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead. Today, these fish traverse up the Sacramento River through Steelhead Creek to spawn in its upper tributaries, and the fry migrate back into the creek to mature. NOAA Marine Fisheries recognizes that small watersheds such as Steelhead Creek are essential to maintaining the genetic diversity of the Central Valley salmonid population (Appx. II). However, present conditions in the channel are not conducive to supporting these fish.

Aside from the channel being the main conduit for migrating salmonids, the banks and floodplain of Steelhead Creek support an ecologically important riparian corridor, and the upper reach is a wetlands complex. These are all important terrestrial and aquatic habitats important to the waterway's ecosystem. Steelhead Creek supports a verdant and ecologically important riparian habitat for a host of aquatic organisms, as well as beavers, otters, skunks, raccoons and other mammals, numerous bird species, and many native plants.

Unfortunately, years of ecological neglect, illegal dumping, and the latest threat—uncontrolled homeless camping—have significantly damaged Steelhead Creek (Photo 1). Because of its attractive natural setting, the riparian corridor has become the epicenter of squatting, and related impacts have pushed the creek's aquatic habitat to its tipping point through discharge of solid and toxic waste (including human feces); trampling and removal of vegetative understory; increased bank failure and sedimentation into the creek; accumulation of debris in the channel; and increased water temperature through destruction of over-story trees.

## 1.2 Location and Access

Steelhead Creek, also known as the Natomas East Drainage Canal, is the largest undammed stream in Sacramento County. Its waters flow south from sources east of Highway 99 in Yolo

County, then in Sacramento, it turns west at the W. El Camino bridge near Garden Highway, entering the Sacramento River at Discovery Park. Its lower reach, downstream of the W. El Camino bridge, is within the American River Parkway (Appx. I).

Although its tributaries are largely ephemeral, water flows through the main channel of Steelhead Creek all year around: during the winter from runoff, and in the late summer and fall from drainage of rice fields up north.

Although a larger "footprint" potentially extending from Northgate Ave. to the confluence with Arcade Creek was originally proposed for the Project, the explosive growth of water primrose the past two years covered much of the channel, obscuring underlying debris and making wading difficult to impossible. The work area was then adjusted to be the left bank (as viewed downstream) of Steelhead Creek 0.7 mi between the Northgate and W. El Camino bridges, solely within the Parkway (Video 2).

Access to the sites was easy once Park Rangers gave us a gate key. We entered the Northgate area along the frontage road, staging vehicles and horses just off the paved bike trail. Arden-Garden and W. El Camino were accessed from the county road off Colfax Ave., then the lower levee road. Vehicles were staged in grass-free areas near each of the bridges.

### 1.3 Role of Solid Debris in Channel

Solid waste in the channel degrades the aquatic environment in two main ways: 1) bed armoring and 2) debris trapping.

Bed armoring occurs when debris, mainly textiles like blankets, tents, mattresses, and clothing; sheet plastic such as tarps and plastic bags; and tires line the channel bottom. Bed armoring by textiles can be several inches thick and weigh hundreds of pounds; a saturated mattress can weigh over 850 lbs, making it nearly impossible to remove by hand. When the textiles become laden with sand, they form an armor that prevents aquatic organisms—food stuff for fish and higher vertebrates—from accessing the substrate. Decomposing organic matter in the substrate is normally cleansed during high flows. But armor prevents oxygen-rich water from penetrating the substrate, thus creating an anoxic "dead zone" which is indicated by the "burp" of foul-smelling, gray water that emerges whenever this armor layer is removed. This anoxic zone inhibits the production of invertebrate food species upon which salmonids and other aquatic organisms depend.

Debris trapping occurs when large, solid debris, mainly shopping carts, office chairs, and bicycles, are thrown into the channel (Photo 4). There, they trap natural flotsam such as wood and aquatic plants, and textile debris, accreting initially to form islands, then peninsulas. In Steelhead Creek, aquatic primrose grows on these structures, progressively enlarging the obstructions and trapping more debris until, in places, nearly the entire channel is obstructed, posing a barrier to fish passage and reducing the channel's flow conveyance capacity, which leads to flooding and bank erosion (Photo 5). Adjacent to the Arden-Garden bridge, one such peninsula formed on a shopping cart and a trapped carpet remnant, extended from the bank 20 ft into the channel, and reduced the normal-flow conveyance capacity by 40 percent.

## 1.4 Role of Invasive Non-Native Vegetation

### 1.4.1 Scarlet Wisteria

Scarlet wisteria (*Sesbania punicea*) is an invasive, non-native deciduous shrub or small tree (family *Fabaceae*), that grows up to 12 ft tall (Photos 2, 5). It goes to seed in late summer and fall. Reproductive individuals produce 100-1000 seed pods/year, with 5-10 seeds/pod. Reproductive output can approach 100 seeds/square foot. Germination rates are over 90%.

Originally introduced to California from Argentina as an ornamental shrub in 1930, it has spread throughout riparian areas of the Central Valley. It was first documented in the American River Parkway in 1999. On Steelhead Creek, it forms dense thickets along the low-flow channel so that access to the water for humans and animals becomes difficult to impossible.

According to the California Invasive Plants Council (Cal IPC) scarlet wisteria has a "Severe" impact on ecosystem processes and on the native plant community (Ref).

### 1.4.2 Uruguay Water Primrose

Uruguay water primrose (*Ludwigia hexapetala*) was originally introduced as an aquatic ornamental and is now a scourge of many waterways in the Central Valley (Photos 3, 5). Established some 25 years ago, it has grown exponentially in the past several years. The plants form dense mats above and below the water surface, anchored on thick stalks attached

to the bottom or banks of ponds and streams. It proliferates in sunny areas but is absent in shade, which is why we chose the areas directly beneath the bridges for the "metric" sites.

The primrose out competes native aquatic and terrestrial vegetation, covers open water and terrestrial zones, which impacts native fauna and lowers species diversity, and creates habitat beneficial for disease vectors. Root and vegetative growth traps sediment and debris, blocks hydraulic flow, and shades soil and water surfaces, disturbing natural ecosystem processes by sequestering nutrients and creating anerobic conditions. It degrades bird habitat, blocks fish passage, and lowers the quality of water by reducing through flow and anerobic breakdown of dead individuals and trapped organic matter. It spreads rapidly and, as evidenced in a few seasons on Steelhead Creek, can completely block the channel.

According to CAL IPC, when overly dense, as it is in Steelhead Creek, water primrose has a "Severe" impact on the ecosystem processes and on the local plant community (Ref).

### 1.5 Project Purpose and Scope

Although thousands of pounds of trash have been removed from the banks and floodplain of Steelhead Creek through numerous organized clean-ups, the channel has never been cleaned and is in woeful condition. Debris in the channel, particularly textiles and tires, armors the substrate, causing an underlying anoxic "dead zone," and forms obstructions upon which debris and invasive aquatic vegetation accrete, disrupting fish passage, impeding flood waters, and exacerbating bank erosion. Invasive, non-native scarlet wisteria crowd out native species along the riparian corridor while water primrose degrades the water quality and obstructs fish passage.

Our previous surveys have demonstrated that between 0.5 and 1.5 hours are needed to manually remove large tires, embedded shopping carts, or a saturated mattress (which weighs over 850 lbs). Cleaning a 15 ft x 20 ft site can take over 6 hours by hand due to the embeddedness, weight, and sheer volume of debris, so is clearly not feasible. Using machinery is problematic due to the difficulty accessing the channel and its significant impact on the habitat. So, to remove debris and invasive vegetation in the water and on the banks, our Project employed a team of draft horses and a hand crew, thereby avoiding the impacts of powered equipment (Photo 6).

## 1.6 Project Approach and Equipment

We began preparing for the Project in early spring, 2020. After outlining our work strategy, the first step was to identify our partners. We were delighted that Save the American River Association agreed to serve as our non-profit sponsor and manage the financial account. Sacramento County Parks agreed to donate in-kind support by removing the spoils and hauling it off. Funding was provided by the Confluence Program of the Sacramento County Regional Sanitation District (Regional San). We were fortunate to locate Scott Borello, a horse logger from Greenwood, who provided an intrepid team of small but mighty Haflinger draft horses. Through the NGO Sacramento Regional Conservation Corps (SRCC), we hired workers to assist with removing, counting, bagging, and weighing the debris. And finally, we applied for and received the Lake and Streambed Alteration (1600) permit from the Department of Fish and Wildlife, allowing us to proceed. However, we were then informed that, owing to covid restrictions, we had to put the Project on hold. A year later we finally got the "all clear" and began work in August, 2021.

Two weeks before beginning field work, we accompanied Park Rangers to identify ourselves to occupants of the homeless camps, to notify them of the upcoming work, and to hand out trash bags. Campers were told that they had to remove their dogs during working hours if we were near their campsite, and that they might have to vacate their camps should we need access there; if so, they were to be given two days' notice (no camps had to be vacated).

The first two days we cleaned debris from four abandoned camps along the waterway while experimenting with the best ways to rig and manage the horses and crew. The morning of the third day we set aside for an "open house" for VIPs, agency staff, and the media. Channel 13 and the Sacramento Bee both did stories on the project (Ref).

Equipment and supplies, aside from specialized tack for the horses, included:

<u>Equipment:</u>

- Trailer-mounted Porta-Potty (provided by the SRCC).
- Decrepit but serviceable 8-ft aluminum John boat for use as a barge.
- 6 ea. Long-handled, garden cultivators.
- 4 ea. Litter pickers.
- 2 ea. Garden rakes.
- 3 ea. 10' x 15' Heavy-duty tarps for hand hauling.

- 4 ea. 1-cu yd, Woven nylon, bulk materials handling sacks ("super sacks").
- 4 ea.  Hay hooks for removing debris and hauling tarps (hooked through grommets).
- 3 ea. Weed wrenches. (Extracta-gator brand was better than Puller Bear brand).
- 4 ea. 24" Pruning loppers.
- Metal tape measure and 100' fabric tape measure.
- Various chains, cables, ropes and hooks.
- Rubber chest waders, gloves.

Supplies:

- Plastic (disposable) trash bags.
- Day-Glo survey pin flags for marking debris in channel.
- Materials inventory forms (developed as Project proceeded).

## 1.7 Acknowledgements

We gratefully acknowledge the following individuals who helped make this Project possible: Christoph Dobson and Heidi Oriole of Regional San, for encouraging and helping us by funding this Project, and Nanette Bailey for fiscal matters; Stephen Green of Save the American River Association for agreeing to partner with us and Sara Stephens for ably overseeing our account; Sacramento County Park's Director Liz Bellas for early on agreeing to undertake this Project; Chief Ranger Leonard Orman for capably helping us interface with the campers; James Mitts and the County Parks Camps Maintenance Crew for removing the spoils and reporting the tonnage; Baldeo Singh and Abraham Contreras of the Sacramento Regional Conservation Corps for helping us get the best crew available; Chai Young for supervising the crew and keeping them on task (as well as could be done); our intrepid teamster Scott Borello for his creativity in rigging and expert horse handling, willingness to work a flexible schedule, and strict adherence to safety and appropriate behavior around horses. And, of course, everyone's favorite sweethearts: Belle and Star!

# 2.0 REMOVAL AND HANDLING OF DEBRIS

Removing debris from the channel bottom was intended to: 1) re-expose the substrate and make it available to burrowing organisms; 2) allow mixing of (now anoxic) subsurface pore water with oxygenated flowing water; 3) restore fish passage; and 4) restore flow capacity.

In order to safely complete our work, the water level had to be wadable, the velocity reasonably slow (< 1.0 ft/sec), and ideally clear enough to see the bottom; the discharge was 48 cfs (Appx. III). We started at the downstream end of the work area and worked upstream to minimize muddying the water at the site.

In cases where the stream and the team's travel direction were parallel and the load could not simply be pulled up and out, Scott rigged a pulley system to a tree or bridge pillar in order to allow the load to be pulled perpendicular onto the bank. Once on the bank, the team dragged it to a staging and disposal area. At the end of each day, we notified the County Parks Camps Crew that the debris was ready for removal.

Three "metric sites" were selected for detailing the amounts and types of debris; each of these sites was under a bridge (Northgate, Arden-Garden, and W. El Camino) because primrose does not grow in shade (Appx. I). The dimensions of each of the three metric sites was measured using the fabric tape and the area calculated so that the amount of debris (lbs/sq ft and cu ft/sq ft) could be calculated as a way to convey the extent of contamination.

Once in the staging areas, the debris was placed on tarps where it was sorted and allowed to drain. Classes of debris, such as textile (being particularly problematic ecologically), were tallied on field sheets, then bagged, measured using the metal tape, and weighed with a 100-lb digital scale. Data were recorded on the field sheets and transferred to Excel files for recording and analyses.

Debris from several abandoned camps was catalogued but most was not; the weight removed was reported to us by the County Camps Crew upon disposal.

## 2.1 Large Debris

The main types of large debris in the channel of Steelhead Creek are shopping carts, tires, mattresses, and (probably stolen) bicycles (Photo 7). Shopping carts, and to a lesser extent,

bicycles, are ecologically and hydrologically problematic because they trap transported debris, and, upon being colonized by primrose, first become islands, then peninsulas. This decreases the channel's capacity (particularly high flow) and obstructs fish passage. Our drone (and pedestrian) survey conducted in 2018 identified a number of emergent and probable sub-surface carts and bicycles in the channel. Unfortunately, by the time of our work, the primrose had encroached into the channel so extensively that we were not able to re-locate most of the carts and bicycles.

We began by marking the large debris, such as shopping carts, tires, office chairs, mattresses, and bicycles, with pin flags, and pulled them directly from the channel using the horses.

### 2.1.1 Shopping Carts

When embedded in the sediment, shopping carts are often impossible to remove by hand because they are usually entangled by the primrose (Photo 8). Weighing 40-60 lbs each and being very awkward to maneuver, even non-embedded carts are still difficult to pull out by hand, especially where the bank is steep. However, they were handily removed by the horse team. Ropes or chains were attached to the wheel frame—the strongest structural member of the cart. Although sometimes they had to pull 3-4 times, the horses were able to pull out the most recalcitrant carts, even though some were so rusted they broke apart. Some required crew pulling on "tag lines" to prevent the carts from getting stuck on the bank.

### 2.1.2 Tires and Mattresses

Tires are inevitably embedded in the sediment; once full of sand and mud, a car tire and rim can weigh 100 lbs, and a truck tire over twice that (Photo 9). They are very difficult to remove by hand, and can take over an hour. Using the horses, however, made this task simple and easy (Video 3). Logging tongs were attached to a tire, and once the pull rope was tightened, the tong's jaws securely dug in. The tire was dragged up the bank where its sediment was removed, and then it was pulled to the staging area singly by hand or several at a time.

Mattresses are extremely difficult to remove because they lack solid attachment points and are so heavy. A saturated "single" mattress weighs 850 pounds. Removing it by hand must be done incrementally, allowing drainage before hoisting it the next foot or so. This effort often

tears the mattress apart. However, using the horses and the logging tongs, we were able to lift the mattresses enough to wrap ropes around them like a burrito. Once tied "closed," the horses were re-attached and the mattresses impressively pulled out in one piece and hauled to the staging area to drain.

### 2.3 Textiles and Sheet Plastic

Textiles, including tents, sleeping bags, blankets and clothing; and sheet plastic, such as tarps and large bags, line the channel bottom, preventing invertebrates from accessing the substrate, and creating an anoxic "dead zone" beneath (Photo 10). Much of this material becomes trapped on shopping carts, bicycles, or tires, and fills with sediment, making it difficult to remove.

Textile materials were "fished" from the channel bottom using garden cultivators and put into woven nylon, materials-handling "super sacks" inside the 8-ft aluminum John boat (Video 4). The boat was then maneuvered to the bank, a sling threaded through the bag handles, and the bag, which could weigh several hundred pounds, was pulled up the bank by the horse team, and usually left for a few minutes to drain before it was hauled to the staging area where the contents were sorted, further drained and inventoried.

To extend the life of the sacks, we tried to keep hard materials (metal, glass, wood and hard plastic), which tended to rip the sack, separate from the heavy textiles.

### 2.4 Miscellaneous Debris

The channel bottom is encrusted with miscellaneous solid debris, which was recovered using litter pickers, cultivators, or by hand, placed into the woven sacks for removal, and hauled to the staging area. Because of the numerous classes, it was not practical to individually weigh and calculate volume, so it was bagged together.

### 2.5 Drug Paraphernalia

In the midst of every site, drug paraphernalia such as crack pipes and hypodermic needles, were found, indicating the widespread use of illegal substances by this population. Needles were disposed of in appropriate sharps containers and turned into the Folsom Fire Department.

# 3.0 REMOVAL OF INVASIVE, NON-NATIVE VEGETATION

## 3.1 Scarlet Wisteria

Scarlet wisteria grows as bushy shrubs or small trees, and at the time of this Project, were full of seed pods (Photos 3, 5). Care must be taken when disturbing wisteria that its seeds are not spread or knocked into the water, since they are readily dispersed and have a high germination rate. To minimize this, we formed three-person crews: one would hold a branch while the other would cut it off about three feet from the base using pruning loppers, and a third would gently place it onto a 12 ft x 15 ft heavy-duty tarp that was spread out on the ground. Once the tarp was "full" (between two and ten bushes depending on the size), the tarp was wrapped over the branches and secured, and the bundle carried (across the creek if necessary) to the disposal site, where it was dumped. The bundles were light and easily carried by two or three people.

The remaining stems were not as easily removed. Experimentation showed that stems less than 1 in. in diameter could be pulled out by hand using a weed wrench provided that the ground was either saturated or sandy, which occurred adjacent to the channel. Stems rooted in the native clay were much more difficult and required digging so as not to break off the root; this could take 5-10 minutes each.

Stems greater than 1 in. were difficult to extract by hand, but the horses could easily pull stems as large as 4 in. with root balls nearly 3 ft in diameter. We developed a rigging system that allowed the horses to pull three stems (or bunches). Three, 4-ft lengths of 1/4 in., "flat-link" chain were attached to 8 ft of 3/4 in. rope using shackles. Each of the chains could be easily wrapped around a separate wisteria stem (or bunch) and tied with an over-hand knot, which was then attached to the rope. The rope was then tied to the horses' harness.

Thus, we determined that using the horses for the larger-stemmed plants was much more effective in terms of time and effort than doing it manually (Appx. IV).

## 3.2 Primrose

Primrose grows as dense mats in places, completely choking out the stream (Photos 3, 5). Removing it by hand involved wading into (shallow) water, reaching as deeply as possible to get closest to the root mass, grabbing a handful of the stalks, and pulling out the mass, which

was then stuffed into a super sack in the boat. Pulling required considerable effort, and since the plant masses were heavy, it was extremely difficult to remove the sack from the boat and haul it over the bank and up the slope to the staging area. A sack took two people about 15 minutes to fill, and three people to remove it and arduously haul it up to the disposal site, where it was emptied. This took several minutes as the stems would get tangled in the handles.

Using horse power was a major improvement. We wrapped a 20 ft long, 3/8 in. wire rope having eyes pressed on each end around a 5-ft diameter clump of primrose. The wire rope stayed submerged at the root base. We rigged the eyes to form a choker, and when the horses pulled, the entire mass, roots and all, was tugged out and dragged up the bank (Video 5). By this method, a 5 ft mass weighing up to 500 lbs, could be pulled and hauled off in 5 to 7 minutes which would take many hours and many hands to accomplish manually. By comparing methods of removing primrose by hand with those using the horses, we found the latter to be much more effective in terms of time and effort (Appx. IV).

# 4.0 WORK AREAS AND YIELD

Work was concentrated around the metric sites, where we inventoried, weighed and measured the yield: 1) Northgate bridge, 2) Arden-Garden bridge, and 3) W. El Camino bridge.

## 4.1 Northgate Bridge Area

### 4.1.1 Solid Debris

The Northgate bridge area included several camps along the channel and the metric area beneath the bridge. The County Camps Crew hauled off 10 tons of debris we had collected from several adjacent camps. We did inventory those items but did not weigh them or determine their volume.

Using the horses, an additional 3 tons (240 cu ft) was hauled off from the metric site beneath the bridge (2797 sq ft) (Photo 11). Removed from the water were 145 items, including seven shopping carts, two tires, one mattress, and one large carpet remnant, totaling 847 lbs, amounting to 0.3 lbs/sq ft (Appx. V-A).

From a 9 ft by 23 ft pool just upstream of the bridge, we recovered 11 pieces of textile, totaling 156 sq ft, or covering 75 percent of the bottom area.

### 4.1.2 Vegetation

*Wisteria*

The area upstream from Northgate bridge had dense thickets of wisteria blocking access to the creek, which were perfect for developing removal techniques. Two areas were worked: 1) from the bridge to 80 ft upstream on both sides of the channel, and 2) 825 ft upstream of the bridge on the left side. We cleared both of these areas to 0 percent coverage. Smaller ($\leq$ 1 in.) plants on the bank were pulled by hand and/or using weed wrenches, and the larger ones ($\geq$ 1 in.) using the horses.

We removed 354 wisteria plants (= 304 linear ft). From the bridge site, we removed 88 ft in two hours, and 80 ft (192 plants) from the right bank in 1 hour. From the upstream site, we

removed 135 ft of wisteria consisting of 162 plants. Here, the horses cleared 35 ft of wisteria (46 stalks >1 in.) in 1 1/2 hours.

*Primrose*

Primrose almost completely closed the channel 825 ft upstream from the bridge. Here, the channel is asymmetric with a wide terrace on the left bank and a narrow one on the right. The channel is over 6 ft deep in its center, so wading across was treacherous.

After attempting to pull the stubborn primrose by hand, it was deemed untenable, so we switched to using the horses and the 20-ft wire rope; this was quite successful (Photos 12, 13). The horses made 30 pulls totaling 9190 lbs (340 cu ft). The largest single pull weighed about 500 lbs.

## 4.2 Arden-Garden Bridge Area

The Arden-Garden bridge area included several stream-side camps from which 7.5 tons of debris were removed. The metric site detailed debris removed from the channel. Only minor vegetation was removed, and solely to gain better access to the debris. We spent two days at this area because of the amount of trash and the fact that the Project had to be paused for two weeks when the water level and velocity rose due to draining of the rice fields. Because the bank is steep and the trail parallel to the channel, ropes had to be rigged with a block and tackle to allow the debris to be pulled out of the boat perpendicular to the channel.

### 4.2.1 Solid Debris

From the footprint below the bridge (4406 sq ft), a total of 425 items weighing 4292 lbs (592 cu ft) were recovered, including 32 tires and four shopping carts (Photos 9, 10, 14, and 15). Nearly half the weight (2622 lbs) was textiles, including mattresses and carpet remnants. The shopping carts on the edge of the footprint were densely overgrown with primrose, forming a mid-channel island. Channel armor due to this debris was 0.1 cu ft/ sq ft or 1 lb/sq ft. Once this debris was removed, there was a notable clearing of the water, and sand bars began migrating across the bottom (Appx. V-B).

### 4.3 W. El Camino Bridge Area

The W. El Camino Bridge area included the metric site directly below the bridge and a creek-side camp 300 ft downstream.

#### 4.3.1 Solid Debris

From the metric site (3710 sq ft), 455 items totaling 2319 lbs (128 cu ft) were removed, including one mattress, three carpet remnants, one tire, and one shopping cart (Photos 16, 17 and 18). Sixty percent of the weight (1385 lbs) was textiles. We estimate that we removed about 80 percent of the debris which amounted to 0.03 cu ft/ sq ft and 0.62 lbs/sq ft (Appx. V-C and V-D).

#### 4.3.2 Vegetation

A dense thicket of mature wisteria up to 12 ft tall, some having trunks 4 in. or more in diameter, blocked access to the metric site. Using a combination of 18 hand pulls and 14 horse pulls, 32 plants were removed (Photo 19).

Primrose extended completely across the channel on the downstream side of the bridge but because of the dense shade cast by the canopy of creek side trees, it only extended a short distance downstream. Horses pulled three mats amounting to 2558 lbs (95 cu ft).

# 5.0 CONCLUSION AND EVALUATION

## 5.1 Outcomes

The most important outcome of this Project is that it demonstrated the viability of using horses to: 1) pull sacks of debris and single items out of the channel too heavy or too embedded to be done by hand; 2) extract mature wisteria larger than 1 in. (and its root ball) especially from firm, dry soil; and 3) pull primrose out by its roots (Photo 20). Not only did the horses efficiently remove the material from the channel, of equal importance, they hauled it to the disposal sites as far as 250 ft away. Although pulling could be accomplished using a vehicle and winch, much of the area was inaccessible to vehicles, and the haul-off, which in places was perpendicular to the pull, would be complicated to effect (possibly requiring an additional vehicle).

We catalogued debris removed from the channel on the inventory sheets in order to understand its source. By so doing, we recognized two main generations of debris: 1) "Legacy debris" and 2) "Modern debris". Legacy debris is largely auto parts and tires from the 1950s to'60s, and old construction materials including wire rope, pipe, tile and concrete (Photo 21). This debris appears to have been dumped from the bank or left behind after bridge construction, as it is concentrated in certain areas along the channel. Modern debris includes mainly domestic items consisting of soft material such as mattresses, tents, sleeping bags, plastic tarps, plastic bags, clothes, blankets, carpet remnants (used to cover the ground), and sheets; and hard items such as stoves, furniture, food and beverage containers, fuel cans, bicycle parts (many), office chairs, pots and pans, and other items that are consistently present in the abandoned homeless camps that we have cleaned (Photo 1). Although some may be due to illegal dumping, we think that most is from homeless camps that line the channel (Appx. VI).

## 5.2 Personnel

### 5.2.1 Teamster and Horses

The teamster (Scott Borello) and horses camped on site during work days. Although there were several areas to suitably do this for a few days at a time, it became difficult after that. Horses need adequate feed and especially high-quality water in large quantities. Since Scott

did not want them drinking from the creek, additional sources of water had to be imported to the site. Unless another vehicle was available to get water, the horses would have had to be put back in the trailer and towed to pick up the water because Scott (reasonably) did not want them to be left unattended. As well, Scott slept in his truck and was frequently awakened by foot traffic and urban noises, so he became progressively fatigued and needed to return home after four days.

The Project required highly technical rigging and handling of the team to safely haul debris from the boat and directly from the channel, remove wisteria, and pull the primrose. For future projects, it could be difficult finding a teamster as experienced and knowledgeable as Scott Borello (and the right horses). There are only a few teams within practical driving distance of the area, and it is unknown if they could effect such an unconventional application.

#### 5.2.2 Work Crew

The quality of work we got from the Sacramento Regional Conservation Corps was mixed. Most days we had a crew of seven, but often not the same individuals from day to day which required retraining. Although about half the crew worked well, and there were a few outstanding individuals, the rest did not perform up to expectations; either they were lazy or did not follow instruction, especially when it came to unloading the debris sacks and inventorying their contents. Several were downright rude and insubordinate. Attachment to cell phones was a major problem, and although we required that the crew leave their phones in their vehicle (they could have access during breaks and at lunch), a number refused to abide.

### 5.3 Obstacles Encountered

The main obstacle to greater removal of large debris was the remarkable infestation of primrose which, in much of the creek, completely covered the surface. Comparative drone images show that it has spread as much as 300 percent in two years. Not only was this plant difficult to wade through, it completely obscured underlying debris. We attempted to probe for hidden shopping carts using a length of metal conduit, but passage through the masses became untenable.

The Project met an unforeseeable delay halfway through, when waters were drained from the rice fields upstream, creating unsafe or impossible wading conditions and murky water. Velocity increased from appx. 0.6 ft/sec to 1.32 ft/sec, and discharge from 48 cfs to 180 cfs (Appx. III). We had anticipated the draining to occur later in October, and scheduled the Project to be completed by then. But due to the drought, the drainage occurred a month ahead of schedule, so we had to put the Project in abeyance for three weeks until safe conditions returned.

# 6.0 RECOMMENDATIONS

6.1 We recommend using draft horses to remove debris and vegetation from the channel where access permits. This could be augmented by an ATV with a winch. Such winches are capable of 3000 lbs of pull, which is more than sufficient, but since the ATV weighs only 500-600 lbs, it would have to be secured to a tree in order to keep it from being pulled over. An effective means would then have to be developed to haul the material to the disposal site, possibly a second ATV.

6.2 The large debris remaining in the channel poses a significant obstacle to the passage and rearing of salmonids. Despite the tons removed by this Project, the main source of this debris (creek side homeless camps) remains. We recommend not removing any more debris from the channel until camping withing 150 ft of the creekbank is prohibited and enforced consistent with CDF&W Water Quality Code 5652(a)"

> "It is unlawful to deposit, permit to pass into, or place where it can pass into the waters of the state, or to abandon, dispose of, or throw away, within 150 feet of the high water mark of the waters of the state, any cans, bottles, garbage, motor vehicle or parts thereof, rubbish, litter, refuse, waste, debris….etc."

# 7.0 REFERENCES

Scarlet wisteria:
https://www.cal-ipc.org/plants/paf/sesbania-punicea-plant-assessment-form/

Uruguay water primrose:
https://www.cal-ipc.org/plants/profile/ludwigia-hexapetala-profile/

Channel 13 article:
https://sacramento.cbslocal.com/2021/08/24/horses-pull-homeless-junk-sacramento-creek/)

Sacramento Bee article, edition 8/25/21:
https://www.sacbee.com/news/local/article253747293.html

# APPENDICES

**Appx. I.** Location map

**Appx. II.** NOAA Letter

**Appx. III.** Cross-Section, Arden-Garden bridge

**Appx. IV.** Vegetation Removed

**Appx. V.** Data sheets:

**A.** Northgate Bridge

**B.** Arden-Garden Bridge

**C.** DS W. El Camino Bridge

**D.** El Camino Bridge

**Appx. VI.** Summary of Materials Removed

**PHOTOS:**

1. Abandoned homeless camp on Steelhead Creek at "The Grove" between Arden-Garden and W. El Camino bridges. Camp has since been cleaned out.
2. Scarlet wisteria lines the banks of Steelhead Creek and water primrose clogs the channel's surface.
3. Drone view of wisteria lining banks displacing native vegetation, and primrose closing off channel.
4. Shopping cart embedded in channel. Note encroaching primrose on far bank.
5. Primrose completely covering channel, impeding fish passage and trapping debris.
6. Draft horses Belle and Star and teamster Scott Borello worked successfully in areas not accessible to powered machinery.
7. Large debris removed by horse team from the channel of Steelhead Creek. Scott Borello explaining safety measures.
8. Island in middle of channel has formed on embedded shopping cart entangled in primrose.
9. Horses removed thirty-two embedded tires from metric site at Arden-Garden bridge.
10. Example of 2622 lbs of textiles removed from Arden-Garden metric site.
11. Belle and Star ready to haul out embedded truck tire, Northgate Bridge site.

12. Shopping cart, embedded in substrate and entangled by primrose would have been nearly impossible to remove manually.
13. Upstream of Northgate bridge cleared of primrose and wisteria. Compare with #2, 3.
14. Removing solid debris using “super sacks” and John boat.
15. John boat loaded with debris and super sack. Note how low boat is sunk into water. Arden-Garden metric site.
16. Removing primrose from embedded shopping cart so horses can pull it. Northgate metric site.
17. Scott and team pulling trash bin full of camp waste from channel.
18. Staging area as seen from the W. El Camino bridge.
19. Staged wisteria, W. El Camino bridge. Note large trunks in foreground.
20. Belle, Star and Scott pull a sack of primrose weighing over 300 lbs.
21. “Legacy debris” dumped during the 1950s and ‘60s has little effect on the aquatic habitat, aside from tires.

**ATTACHMENTS:**

**Videos:**

Video 1. Homeless camping at The Gove between Arden-Garden and W. El Camino bridges.

Video 2. Steelhead Creek drone flyover, 23-Aug. 2021.

Video 3. Horses pulling embedded tire, Arden-Garden bridge. Video by Kathy Kayner.

Video 4. Loading debris in boat to be hauled onto bank by horses. Arden-Garden bridge. Video by Kathy Kayner.

Video 5. Horses and crew at work, W. El Camino bridge.

**LETTER OF TRANSMITTAL:**

**Appendix I**. Location map showing three work areas along Steelhead Creek in the American River Parkway: Northgate, Arden-Garden, and W. El Camino. North to top of page. Yellow triangles indicate occupied and unoccupied homeless camps on left bank as of 23 Aug. 2021. Camps on right bank not surveyed.

**Appendix II.** Letter from NOAA

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 capitol Mall, Suite 5-100
Sacramento, California 95814-4700

April 22, 2019

Roland Brady, PhD
1728 F St.
Sacramento, California 95811

Re: Letter of Support for DWR Urban Streams Restoration Program

On behalf of NOAA's National Marine Fisheries Service (NMFS), West Coast Region, California Central Valley Office, please allow this letter to serve as support for the Steelhead Creek Salmonid Habitat Enhancement Project.

Steelhead Creek is located in the Dry Creek Watershed as defined in the NMFS 2014 Recovery Plan for Central Valley Steelhead, Sacramento River Winter Run Chinook, and Central Valley Spring Run Chinook (henceforth referred to as Recovery Plan).

Some of the major threats identified in the Recovery Plan for the Dry Creek Watershed include: removal of native vegetation and placement of non-native species, development of areas where vegetation removal has occurred, and/or allowing these areas to remain bare/un-vegetated; increased erosion; and decreased water quality from agricultural or anthropogenic development.

Throughout the watershed, reaches have been straightened, floodplain area reduced, reaches dredged, and riparian vegetation removed, resulting in eroding banks, sediment deposition, lack of cover, lack of pools and riffles, lack of riparian vegetation, and barriers to fish passage.

Despite this impairment to much of the available habitat, the Dry Creek watershed does support a relatively healthy riparian corridor upstream of Folsom Road to the confluence with Miners and Secret ravines. Restoration projects on Steelhead Creek are likely to benefit the entire watershed, including listed species that rear in and traverse this creek.

The Recovery Plan identifies the following specific actions that if implemented would contribute towards the recovery of listed species in the watershed:

- Pursue grant funding or cost-share payments for landowners to inventory, prepare plans and implement best management practices that reduce water quality impacts in the Dry Creek watershed.
- Develop a long-term strategy for monitoring and regulating discharges from agricultural lands in the Dry Creek watershed to protect waters within the Central Valley, including enforcing regulations.
- Continue to implement projects designed to minimize chronic road-related erosion on public lands in the Dry Creek watershed.
- Conduct a hydrologic analysis of the Dry Creek watershed that explores conjunctive use opportunities to reduce water allocations that are dependent on surface water.

The proposal provided for consideration under the California Department of Water Resources Urban Streams Restoration Program would create opportunities for salmonid habitat enrichment, emphasizing juvenile survival and maturation in Steelhead Creek. This project proposes to conduct geomorphic, hydrologic, and biologic surveys within Steelhead Creek, including the development of a habitat rehabilitation plan focused on removing debris from the channel bottom, creating refugia, increasing hydrologic diversity, removing invasive species, and stabilizing eroding banks using biotechnical methods. These goals are all consistent with the NMFS Recovery Plan actions identified above.

NMFS supports this project, not only because of its value to our Recovery Plan actions, but also because it helps to meet our goals of community engagement and education. We hope to partner with Dr. Roland Brady and his team to help fulfil his education goals by providing education opportunities for students and volunteers on this project.

NMFS looks forward to participating in future discussions involving the planning, design, and permitting stages of this project. We respectfully encourage you to support this important project for the restoration of a valuable creek and watershed, and we are excited to see this project come to fruition.

Please contact LTJG Caroline Wilkinson, in the NMFS California Central Valley Office, at Caroline.Wilkinson@noaa.gov, or 916-930-3731 if you have any questions concerning this letter or if you require additional information.

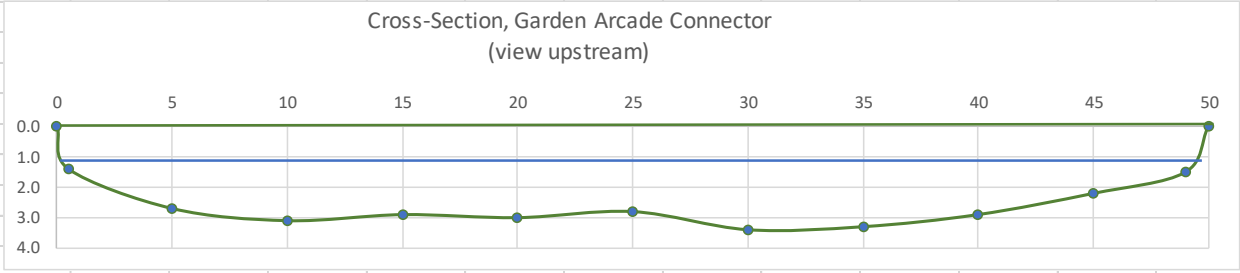
Sincerely,

Amanda Cranford
Sacramento River Basin Branch

Chief cc: To the file 151416-WCR-2019-00004

**Appendix III.** Cross-section, velocity, and discharge, Arden-Garden bridge showing effects of additional

| Aug. 31, 0900 (blue) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dist | 0 | 0.5 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 49 | 50 | Ave. | Area |
| Depth | 0 | 0.2 | 1.6 | 2 | 1.8 | 1.9 | 1.7 | 2.3 | 2.2 | 1.8 | 1.1 | 0.4 | 0 | 1.7 | 82.3 |
| Sept. 1, 0800 (green) | | | | | | | | | | | | | | | |
| Dist | 0 | 0.5 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 49 | 50 | Ave. | Area |
| Depth | 0 | 1.4 | 2.7 | 3.1 | 2.9 | 3.0 | 2.8 | 3.4 | 3.3 | 2.9 | 2.2 | 1.5 | 0 | 2.8 | 136.2 |




| Velocity | Aug. 31, 0900 | | | V=ft/sec | V Ave. | | Discharge = Q = V * A = | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (100 ft) | 1 | 205 | sec | 0.49 | 0.58 | ft/sec | V (ft/sec) | * | A (ft2) | | |
| | 2 | 141 | sec | 0.71 | | | 0.58 | * | 82.3 | = | **47.9 ft3/sec** |
| | 3 | 182 | sec | 0.55 | | | | | | | |
| Velocity | Sept. 1, 0800 | | | V=ft/sec | V Ave. | | Discharge = Q = V * A = | | | | |
| (90 ft) | 1 | 68 | sec | 1.32 | 1.32 | ft/sec | V (ft/sec) | * | A (ft2) | | |
| | 2 | 70 | sec | 1.29 | | | 1.32 | * | 136.2 | = | **179.5 ft3/sec** |
| | 3 | 67 | sec | 1.34 | | | | | | | |

## **Appendix IV.** Vegetation Removed

**Northgate Bridge Area**

**Wisteria**

| No. piles | ft | ft | ft | Pile vol (cu ft) | Total Vol (cu ft) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 7.0 | 1.5 | 2.0 | 21 | 21 | | | | |
| 4 | 7.0 | 3.5 | 2.0 | 49 | 196 | Bridge | | | |
| 7 | 6.0 | 2.5 | 2.0 | 30 | 210 | | | | |
| | | | | | **427** | | | | |
| 1 | 14.0 | 6.5 | 1.8 | 164 | 164 | Upstream | | | |
| | | | | **Total** | **591** | | | | |
| Plants removed > 1" | | | 354 | | | | | | |
| Ft cleared | | | 304 | | | | | | |

**Primrose**

| No. piles | ft | ft | ft | Pile vol (cu ft) | Total Vol (cu ft) | | Est. Wt. @ Density | (lbs) 27 | pcf |
|---|---|---|---|---|---|---|---|---|---|
| 9 | 3.5 | 2.5 | 1.0 | 9 | **79** | Bridge | **2126** | | |
| 1 | 4.0 | 3.5 | 2.2 | 31 | 31 | | 832 | | |
| 2 | 3.3 | 4.5 | 1.7 | 25 | 50 | | 1363 | | |
| 1 | 6.0 | 3.0 | 1.5 | 27 | 27 | | 729 | | |
| 3 | 3.5 | 2.2 | 2.2 | 17 | 51 | Upstream | 1372 | | |
| 4 | 2.4 | 2.5 | 2.4 | 14 | 58 | | 1555 | | |
| 1 | 3.0 | 2.8 | 1.8 | 15 | 15 | | 408 | | |
| 7 | 3 | 2.7 | 1.4 | 11 | 79 | | 2143 | | |
| 2 | 3.3 | 2.6 | 1.7 | 15 | 29 | | 788 | | |
| Horse pulls | | 30 | | **Total** | **340** | | **9190** | | |

**W. El Camino Bridge Area**

**Wisteria**

| No. piles | ft | ft | ft | Pile vol (cu ft) | Total Vol (cu ft) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 21.0 | 6.0 | 3.0 | 378 | 378 | | | | |
| | | | | **Total** | **378** | | | | |
| Plants removed > 1" | | | 32 | | | | | | |
| Ft cleared | | | 30 | | | | | | |

**Primrose**

| No. piles | ft | ft | ft | Pile vol (cu ft) | Total Vol (cu ft) | | Est. Wt. (lbs) @ Density | 27 | pcf |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.0 | 6.0 | 1.4 | 17 | 17 | | 454 | | |
| 1 | 5.4 | 3.0 | 1.7 | 28 | 28 | | 744 | | |
| 1 | 5.6 | 6.0 | 1.5 | 50 | 50 | | 1361 | | |
| Horse pulls | | 3 | **Area** | **Total** | **95** | | **2558** | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Total** | **386** | **Plants** | **Wisteria** | | | | | | |
| | **11,748** | **Lbs** | **Primrose** | | | | | | |

**Appendix V-A.** Data Sheet, Northgate Bridge

| | | | |
|---|---|---|---|
| **Site: Northgate bridge** | 38.604641°N -121.475573° W | Date: | Aug. 24, 2021 |
| In-channel removal. | | | |
| Perimeter: 219.8 ft | Area: 2797 sq. ft. | | |
| Desc: Beneath bridge. | | | |
| Comment: Pulled by boat and horses. | | | |

| Item | Note | No. | Wt lbs (est) |
|---|---|---|---|
| **Textiles:** | | **58** | 325 |
| Blanket, sleeping bag, quilt, pillow | | 17 | |
| Clothing (large-coat, shirt, pants) | | 8 | |
| Clothing (small- underwear, hat, sock, glove) | | 14 | |
| Tent or fragment of | | 6 | |
| Carpet remnant | | 1 | |
| Storage or transit bag | | 4 | |
| Mattress, pad | | 2 | |
| Misc. | | 6 | |
| Note: | | | |
| **Plastic:** | | **34** | 30 |
| Tarp (larger than 1' x 1') | | 1 | |
| Bag | | 4 | |
| Fragment (smaller than 1' x 1') | | 12 | |
| Plastic container (large > 1 qt) | | 5 | |
| Plastic container (small < 1 qt) | | 11 | |
| Tent pole | | 0 | |
| Fishing line | | 0 | |
| Misc. | Pipe | 1 | |
| Note: | | | |
| **Rubber:** | | 20 | 70 |
| Truck tire/tube | @ 30 lbs | 2 | 60 |
| Automobile tire/tube | | 7 | |
| Bicycle tire/tube | | 5 | |
| Hose | | 0 | |
| Foam mat | | | |
| Misc. | | 6 | |
| Note: | | | |
| **Metal:** | | **21** | 405 |
| Shopping cart | Ave 55 lbs | 7 | 385 |
| Bicycle frame | | 0 | |
| Bicycle part inc. rim. | | 1 | |
| Automotive part | | 0 | |
| Metal container | | 6 | |
| Cooking items inc pots and pans | | 1 | |
| Lawn chair, office chair or parts | | 1 | |
| Gas cylinder | | 0 | |
| Misc. | | 12 | |
| Note: | | | |
| **Electronics and Electrical:** | | **5** | 8 |
| Wire | | 0 | |
| Stereo, phone, computer equipment | | 1 | |
| Household electrical (fan, microwave) | | 0 | |
| Power tool | | 0 | |
| Misc. | | 4 | |

| Paper, Wood, Fiberglass, Cardboard: | | | 5 |
|---|---|---|---|
| Book, magazine | | | |
| Container | | | |
| Board | | 3 | |
| Misc. | | | |
| Note: | | | |

| Item | Note | No. | Wt lbs (est) |
|---|---|---|---|
| **Glass and Ceramic:** | | **7** | 3 |
| Container | | 7 | |
| Misc: | | | |
| Note: | | | |
| **Hazardous materials:** | | **0** | 1 |
| Batteries | | 3 | |
| Hypodermic syringe | | 4 | |
| Motor oil | | 0 | |
| Gasoline container | | 0 | |
| Pesticide container | | 0 | |
| Human excrement | | 0 | |
| Paint container | | 0 | |
| Misc. | | 0 | |
| Note: | | | |

| **TOTALS:** | **Items (min)** | **Est Wt (lbs)** |
|---|---|---|
| | **145** | **847** |
| **Area covered (sq ft)** | **2797** | |
| **Lbs/sq ft** | **0.3** | |

## **Appendix V-B.** Data Sheet, Arden-Garden bridge

**Site: Arden-Garden bridge** 38.606105°N, -121.469668°W Date: 8-25, 30, 31, 2021

In-channel removal.

Perimeter: 318.7 ft Area: 4406 sq ft

Desc: Beneath bridge.

Comment: In-channel debris pulled with boat and horses.

| Item | Note | No. | Vol (Ft3) | Wt (lbs) |
|---|---|---|---|---|
| **Textiles:** | **50%** | **214** | **384** | **2622** |
| Blanket, sleeping bag, quilt, pillow | | 49 | 137 | 666 |
| Clothing (large-coat, shirt, pants) | | 58 | 32 | 400 |
| Clothing (small- underwear, hat, sock, glove) | | 54 | 165 | 756 |
| Tent or fragment of | | 22 | | |
| Carpet remnant | | 8 | | |
| Storage or transit bag | | 6 | | |
| Mattress, pad inc. foam | | 11 | | |
| Misc. | | 6 | | |
| Note: | Mattress and carpet combined | | 50 | 800 |
| **Plastic:** | **22%** | **94** | **88** | **60** |
| Tarp (larger than 1' x 1') | | 23 | 88 | 60 |
| Bag | | 27 | | |
| Fragment (smaller than 1' x 1') | | 17 | | |
| Plastic container (large > 1 qt) | | 9 | | |
| Plastic container (small < 1 qt) | | 1 | | |
| Tent pole | | 3 | | |
| Toy | | 4 | | |
| Fishing line | | 0 | | |
| Misc. | | 10 | | |
| Note: | | | | |
| **Rubber:** | **9%** | 40 | **70** | **960** |
| Truck tire/tube | Ave diam 2.0; V= @ 30 lbs ea. | 2 | 70 | 960 |
| Automobile tire/tube | | 30 | | |
| Bicycle tire/tube | | 7 | | |
| Hose | | 0 | | |
| Misc. | | 1 | | |
| Note: | | | | |
| **Metal:** | **7%** | **31** | **42** | **400** |
| Shopping cart | | 4 | 42 | 400 |
| Bicycle frame | | 6 | | |
| Bicycle part inc. rim. | | 13 | | |
| Automotive part | | 2 | | |
| Metal container | | 1 | | |
| Cooking items inc pots and pans | | 3 | | |
| Lawn chair, office chair or parts | | 3 | | |
| Gas cylinder | | 1 | | |
| Misc. | | 2 | | |
| Note: | | | | |
| **Electronics and Electrical:** | **4%** | **15** | **0.0** | **0.0** |
| Wire | | 11 | | |
| Stereo, phone, computer equipment | | 2 | | |
| Household electrical (fan, microwave) | | 0 | | |
| Power tool | | 1 | | |
| Misc. | | 1 | | |
| Note: | | | | |

| Paper, Wood, Fiberglass, Cardboard: | 1% | 6 | | 0.0 | 0.0 |
|---|---|---|---|---|---|
| Book, magazine | | 0 | | | |
| Container | | 2 | | | |
| Board | | 4 | | | |
| Misc. | | 0 | | | |
| Note: | | | | | |

| Item | Note | No. | | Vol (Ft3) | Wt (lbs) |
|---|---|---|---|---|---|
| **Glass and Ceramic:** | **5%** | **23** | | **0.0** | **0.0** |
| Container | | 9 | | | |
| Fragments | | 14 | | | |
| Note: | | | | | |
| **Hazardous materials:** | **0%** | **2** | | **0** | **0** |
| Batteries | | 1 | | | |
| Hypodermic syringe | | | | | |
| Motor oil | | | | | |
| Gasoline container | | | | | |
| Pesticide container | | | | | |
| Human excrement | | | | | |
| Paint container | | 1 | | | |
| Misc. | | | | | |
| Note: | | | | | |
| **Miscellaneous materials:** | **(5 bags)** | | | **8** | **250** |

| **TOTALS** | **Items (min)** | **Vol (cu ft)** | **Wt (lbs)** |
|---|---|---|---|
| | **425** | **592** | **4292** |

| | |
|---|---|
| **Area covered Ft2** | **4406** |
| **Ft3/Ft2** | **0.1** |
| **Lbs/Ft2** | **1.0** |

**Appendix V-C.** Data Sheet, DS of W. El Camino Bridge

**Site: DS W. El Camino Bridge** (38.610630°, -121.46734°) Date: 18-Oct. 2021
In-channel and bank removal.
Area: 30 ft x 10 ft
Desc: Abandoned camp.
Comment: Pile size: 9' x 7.5' x 1.9'

| Item | Note | No. | Vol (Ft3) | Wt (lbs) |
|---|---|---|---|---|
| **Textiles:** | | **33** | **30** | **97** |
| Blanket, sleeping bag, quilt, pillow | | 3 | 6 | 32 |
| Mattress, pad | | | 10 | 39 |
| Clothing (large-coat, shirt, pants) | | 25 | 14 | 26 |
| Clothing (small- underwear, hat, sock, shoe) | | 2 | | |
| Tent or fragment of | | 1 | | |
| Carpet remnant | | 1 | | |
| Storage or travel bag | | 1 | | |
| Misc. | | | | |
| **Plastic:** | | **173** | **5** | **5** |
| Tarp (larger than 1' x 1') | | 1 | | |
| Bag (large) | Inc. yellow cleanup bag handed out 2 weeks ago. | 14 | | |
| Small bag or fragment (smaller than 1' x 1') | | 74 | | |
| Plastic container (large > 1 qt) | | | | |
| Plastic container (small < 1 qt) | | 65 | | |
| Fishing line | | | | |
| Styrofoam | | 18 | | |
| Tent pole | | | | |
| Toy | | | | |
| Furniture | | | | |
| Bucket kor trash can | | | | |
| Misc. | Roll of hard plastic (flooring?) | 1 | 5 | 5 |
| Note: | | | | |
| **Rubber:** | | 8 | **4** | **54** |
| Truck tire/tube | @ 27 lbs ea | 2 | 4 | 54 |
| Automobile tire/tube | | | | |
| Bicycle tire/tube | | 5 | | |
| Hose | | 1 | | |
| Foam mat | | | | |
| Misc. | | | | |
| Note: | | | | |
| **Metal:** | | **17** | **15** | **72** |
| Shopping cart | | | | |
| Bicycle frame | | | | |
| Bicycle part inc. rim. | Wheel | 1 | 2 | 4 |
| Automotive part | Rim | 1 | | 30 |
| Container | | 7 | | |
| Cooking items inc pots and pans | | | | |
| Gas cylinder | | | | |
| Furniture or parts of | Office chair | 1 | 13 | 38 |
| Misc. | | 7 | | |
| Note: | | | | |

| Electronics and Electrical: | | 2 | 0 | 0 |
|---|---|---|---|---|
| Wire | | 2 | | |
| Stereo, phone, computer equipment | | | | |
| Household electrical (fan, microwave) | | | | |
| Power tool | | | | |
| Misc. | | | | |
| Note: | | | | |
| **Paper, Wood, Fiberglass, Cardboard:** | | **9** | **0** | **0** |
| Book, magazine | | 1 | | |
| Container | | 8 | | |
| Board | | | | |
| Misc. | | | | |
| Note: | | | | |
| **Item** | **Note** | **No.** | **Vol (Ft3)** | **Wt (lbs)** |
| **Glass and Ceramic:** | | **9** | **0** | **0** |
| Container | | 2 | | |
| Fragment (> 1"x1") | | 6 | | |
| Misc: | Meth pipe | 1 | | |
| Note: | | | | |
| **Hazardous materials:** | | **1** | **0** | **0** |
| Batteries | | | | |
| Hypodermic syringe | | | | |
| Motor oil | | | | |
| Gasoline container | | | | |
| Pesticide container | | | | |
| Human excrement | | | | |
| Paint container | | | | |
| Misc. | AntiFreeze bottle | 1 | | |
| Note: | | | | |
| **Debris** | | | **16** | **121** |
| From above bagged together | | | 9 | 39 |
| | | | 8 | 35 |
| Individual items | | | 24 | 47 |
| Bagged textiles (3) | | | 30 | 97 |
| Pile size: 9' x 7.5' x 1.9' | | | | |
| Inc. 7 bags, office chair, lounge chair, 2 tires | | | | |

| **TOTALS:** | **Items (min)** | **Vol (ft3)** | **Wt Lbs** |
|---|---|---|---|
| | **252** | **54** | **227** |

| | |
|---|---|
| **Area covered Ft2** | **300** |
| **Ft3/Ft2** | **0.2** |
| **Lbs/Ft2** | **0.8** |

## **Appendix V-D.** Data Sheet, W. El Camino Bridge

**Site: W. El Camino Bridge** Date: 19-Oct., 2021

In-channel debris.

Area: 53' wide x 70' channel = 3710 sq ft.

Desc:

Comment: Used supersacks and boat, haul-out with horses. Sorted, bagged, weighed, measured.

| Item | Note | No. | Vol (Ft3) | Wt (lbs) |
|---|---|---|---|---|
| **Textiles:** | | **60** | **14** | **1385** |
| Blanket, sleeping bag, quilt, pillow | | 1 | 5 | 51 |
| Clothing (large-coat, shirt, pants) | | 21 | 4 | 61 |
| Clothing (small- underwear, hat, sock, glove) | | 23 | 5 | 75 |
| Tent or fragment of | | 2 | 19 | 1198 |
| Carpet remnant | | 3 | | |
| Storage or transit bag | | 4 | | |
| Mattress, pad | Wt = Vol X 62.4 pcf | 1 | | |
| Misc. | | 5 | | |
| **Plastic:** | | **285** | **32** | **106** |
| Tarp (larger than 1' x 1') | | 4 | 3 | 106 |
| Large bag | | 71 | 10 | |
| Small bag or gragment (smaller than 1' x 1') | | 77 | 8 | |
| Plastic container (large > 1 qt) | | 21 | 6 | |
| Plastic container (small < 1 qt) | | 80 | 5 | |
| Fishing line | | 0 | | |
| Styrofoam | | 5 | | |
| Tent pole | | 0 | | |
| Toy | | 0 | | |
| Lawn chair | | 0 | | |
| Plastic bucket or can | | 2 | | |
| Misc. | | 25 | | |
| ***Rubber:*** | | **6** | **17** | **528** |
| Truck tire/tube | | 0 | 4 | 41 |
| Automobile tire/tube | | 1 | 7 | 455 |
| Bicycle tire/tube | | 3 | 5 | 28 |
| Hose | | 0 | 1 | 4 |
| Foam mat | 2 @ same ht. Wt = Vol X 62.4 pcf | 2 | | |
| Misc. | | 0 | | |
| **Metal:** | | **53** | **54** | **271** |
| Shopping cart | | 1 | 20 | 49 |
| Bicycle frame | | 1 | 5 | 26 |
| Bicycle part inc. rim. | | 1 | 1 | 20 |
| Automotive part | | 2 | 24 | 150 |
| Metal container | | 37 | 5 | 26 |
| Cooking items inc pots and pans | | 0 | | |
| Lawn chair, office chair or parts | | 0 | | |
| Gas cylinder | | 6 | | |
| Tool (non electric) | | 0 | | |
| Pipe tubing | | 3 | | |
| Misc. | (Includes Cyclone fence roll, sign) | 3 | | |
| **Electronics and Electrical:** | | **2** | **0** | **10** |
| Wire | | 1 | 0 | 10 |
| Stereo, phone, computer equipment | | 1 | | |
| Household electrical (fan, microwave) | | 0 | | |
| Power tool | | 0 | | |
| Misc. | | 0 | | |

| Paper, Wood, Fiberglass, Cardboard: | | 22 | | 5 | 9 |
|---|---|---|---|---|---|
| Book, magazine | | 2 | | 5 | 9 |
| Container | | 16 | | | |
| Boards-small | | 4 | | | |
| Boards-large | | 0 | | | |
| Misc. | | | | | |
| **Item** | **Note** | **No.** | | **Vol (Ft3)** | **Wt (lbs)** |
| Glass and Ceramic: | | 12 | | 6 | 9 |
| Container | | 4 | | 6 | 9 |
| Fragment | | 7 | | | |
| Misc: | | 1 | | | |
| Hazardous materials: | | 15 | | 0 | 1 |
| Batteries | | | | 0 | 1 |
| Hypodermic syringe | | 14 | | | |
| Motor oil | | | | | |
| Gasoline container | | | | | |
| Pesticide container | | | | | |
| Human excrement | | | | | |
| Paint container | | | | | |
| Cleanser | | | | | |
| Misc. | | 1 | | | |
| Miscellaneous | | NA | | 10 | 44 |
| Small debris | | | | 3 | 10 |
| | | | | 7 | 34 |

| TOTALS: | Items (min) | Vol (ft3) | Wt (lbs) |
|---|---|---|---|
| | 455 | 128 | 2319 |

| | |
|---|---|
| Area covered (53' x 70') $ft^2$ | 3710 |
| $Ft^3/Ft^2$ | 0.03 |
| $Lbs/Ft^2$ | 0.62 |

**Appendix VI.** Summary of Materials Removed

| **Northgate Bridge Area** | | Number | Volume | Weight | | |
|---|---|---|---|---|---|---|
| | | (Items) | (Cu ft) | (Lbs) | | |
| **Debris** | Removed from channel | 145 | NA | 1,102 | Measured | |
| | All area removed | | | 20,000 | Total | |
| **Wisteria** | (>1") 304 ft cleared | 317 | 164 | NA | | |
| **Primrose** | 85 ft cleared | NA | 340 | 9,190 | | |
| | | | | | | |
| | | | | | | |
| **Arden-Garden Bridge Area** | | Number | Volume | Weight* | | |
| | | (Items) | (Cu ft) | (Lbs) | | |
| **Debris** | Removed from channel | 425 | 592 | 4,292 | Measured | |
| | All area removed | | | 21,000 | Total | |
| | | | | | | |
| | | | | | | |
| **W. El Camino Bridge Area** | | Number | Volume | Weight* | | |
| | | (Items) | (Cu ft) | (Lbs) | | |
| **Debris** | Removed from channel | 455 | 128 | 2,319 | Measured | |
| | | 252 | 54 | 227 | | |
| **Wisteria** | (>1") 30 ft cleared | 32 | 378 | NA | | |
| **Primrose** | 30 ft cleared | NA | 95 | 2,558 | | |
| | | | | | | |
| "Measured" is debris removed from channel at metric sites. | | | | | | |
| "Total" = estimate of all debris removed as reported by Parks Camp Crew during haul off. | | | | | | |
| | | | | | | |
| **Total Debris** | | **43,319** | **lbs** | | | |
| **Total wisteria** | | **349** | **plants** | | | |
| **Total primrose** | | **11,748** | **lbs** | | | |
| | | | | | | |
| | | | | | | |

**Photos:**

**Photo 1.** Abandoned homeless camp on Steelhead Creek at "The Grove" in the middle of the Project area between Arden-Garden and W. El Camino bridges. Camp has since been cleaned out.


**Photo 2.** Scarlet wisteria lines the banks of Steelhead Creek and water primrose clogs the channel's surface. Wisteria displaces native riparian vegetation and primrose impedes fish passage and obscures light penetration. View downstream; Northgate bridge in background.

**Photo 3.** Drone view of wisteria lining banks displacing native vegetation, and primrose closing off channel. Appx. 850 ft upstream of Northgate bridge. All primrose and wisteria on right side was removed during Project.

**Photo 4.** Debris trapping. Shopping cart embedded in channel collects flotsam. Note encroaching primrose on far bank.

**Photo 5.** Primrose completely covering channel, impeding fish passage and trapping debris.

**Photo 6.** Draft horses Belle and Star and teamster Scott Borello worked successfully in areas not accessible to powered machinery. Photo by Kathy Kayner.

**Photo 7.** Large debris removed by horse team from the channel of Steelhead Creek. Scott Borello explaining safety measures. Photo by Kathy Kayner.

**Photo 8.** Island in middle of channel has formed on embedded shopping cart entangled in primrose. Photo by Kathy Kayner.

**Photo 9.** Horses removed thirty-two embedded tires from metric site at Arden-Garden bridge. Photo by Kathy Kayner.

**Photo 10.** Example of 2622 lbs of textiles removed from Arden-Garden metric site. This material densely armors channel bottom sealing off invertebrate's access and oxygen to substrate. Photo by Kathy Kayner.

**Photo 11.** Belle and Star ready to haul out embedded truck tire, Northgate Bridge site. Photo by Kathy Kayner.

**Photo 12.** Shopping cart, embedded in substrate and entangled by primrose, would have been nearly impossible to remove manually. It was readily pulled by horse team. Northgate area.

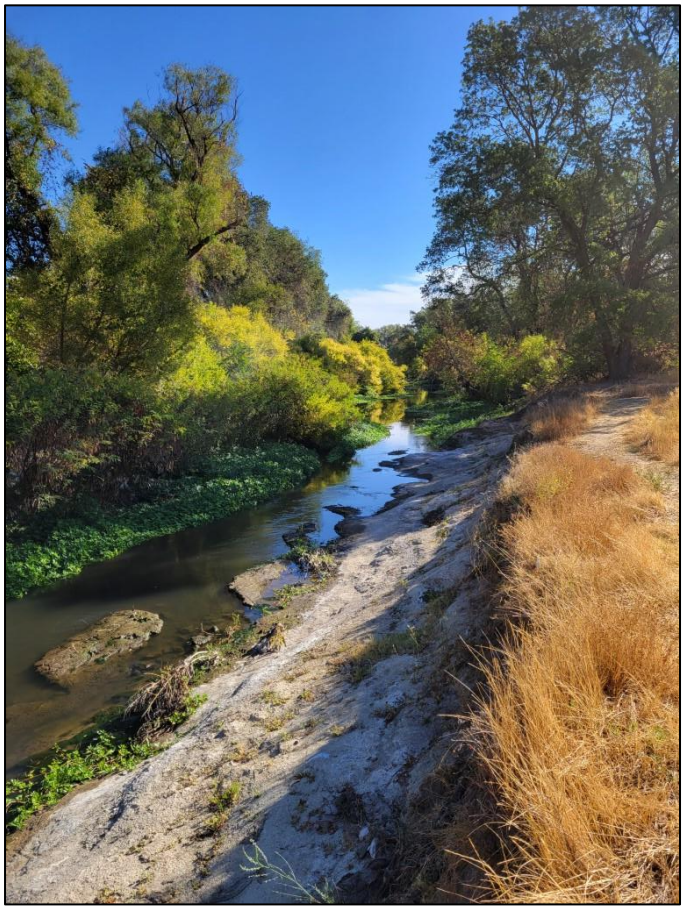


**Photo 13.** Upstream of Northgate cleared of primrose and wisteria. Compare with 2, 3.

**Photo 14.** Removing solid debris using “super sacks” and John boat. Sack, weighing 150 lbs is attached to horse team. Note rigging for perpendicular pull. Arden-Garden metric site.

**Photo 15.** John boat loaded with debris and super sack. Note how low boat is sunk into water. Arden-Garden metric site. Photo by Kathy Kayner.

**Photo 16.** Removing primrose from embedded shopping cart so horses can pull it. Northgate metric site.

**Photo 17.** Scott and team pulling trash bin full of camp waste from channel. Note piled wisteria on left beneath W. El Camino bridge.

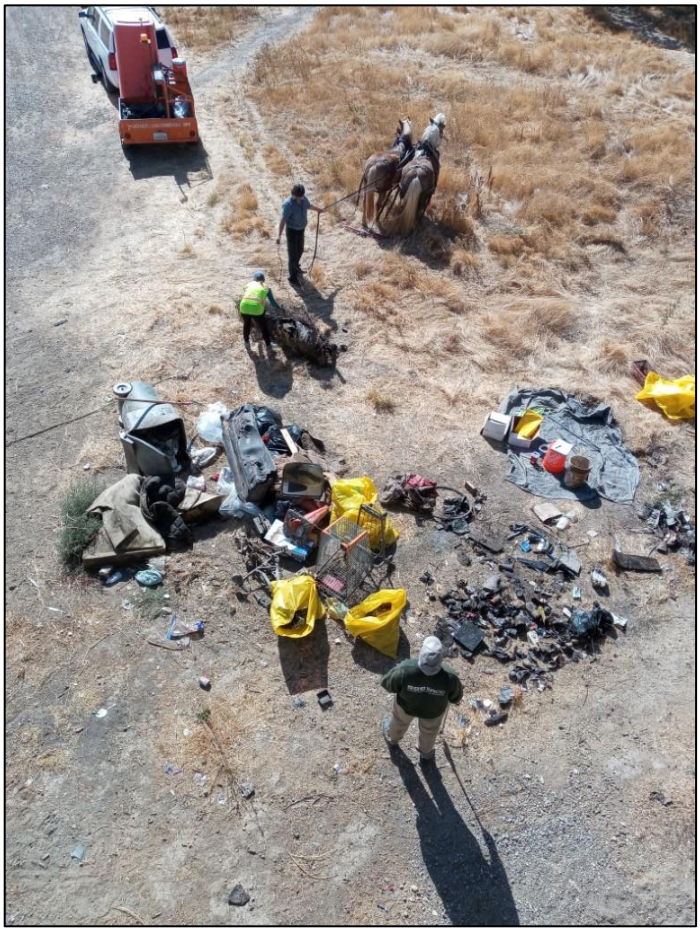


**Photo 18.** Staging area as seen from the W. El Camino bridge. Debris is sorted, catalogued, bagged, weighed, and the volume measured.

**Photo 19.** Staged wisteria, W. El Camino bridge. Note large trunks in foreground.

**Photo 20.** Belle, Star and Scott pull a sack of primrose weighing over 300 lbs. This team was essential to the Project. Not only could they remove heavy loads from the creek, they could haul it to disposal sites as far as 250 ft away. Photo by Kathy Kayner.

**Photo 21.** "Legacy debris" dumped during the 1950s and '60s has little effect on the aquatic habitat, aside from tires. Photo by Kathy Kayner.

# BRADY and ASSOCIATES
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Nov. 29, 2021

**LETTER OF TRANSMITTAL**

I certify that the methods and procedures used in the Steelhead Creek Draft Horse Stream Channel Cleanup Project are consistent with current standards and practice. If you have any questions or desire further information, please contact me at the above.

With best regards,

Roland H. Brady III, Ph.D., P.G.

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