

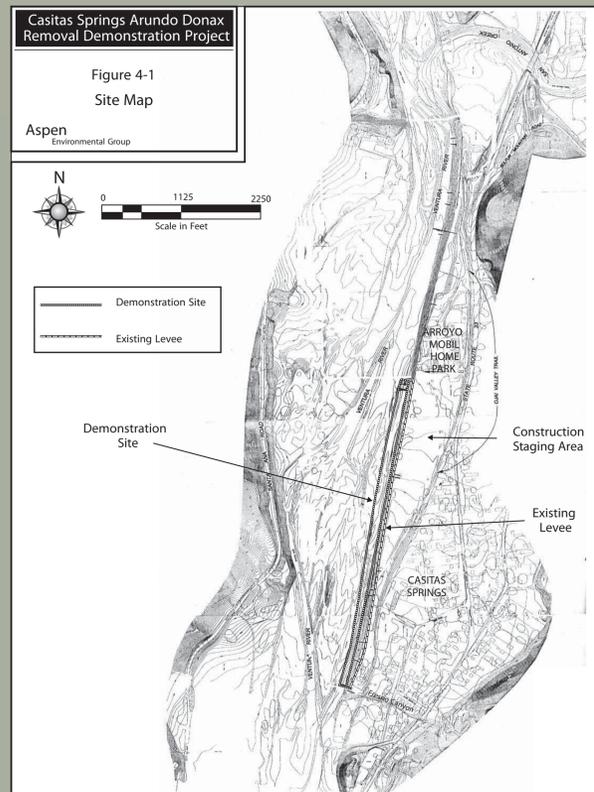
# Ventura River Arundo Removal Demonstration Project

Ventura County Watershed Protection District • Ventura County Resource Conservation District • Natural Resources Conservation Service

**INTRODUCTION:** This project included a cost analysis for the removal of *Arundo donax* (giant cane) from a 5-acre site located along the east bank of the Ventura River, near the community of Casitas Springs, in Ventura County, California. The project was to consist of an initial Arundo removal effort, followed by repeat removal treatments, native plant re-establishment, and revegetation monitoring over a 7-year period. The removal activities began September 1, 2004 and were completed on October 13, 2004. However, during the following winter (2004/2005), Ventura County experienced record rainfall events that triggered severe flooding throughout many parts of the County, including the Ventura River watershed. As a direct result of that flooding, much of the project area was scoured by high flows during peak rain events. Site conditions in the locations of Methods 1 and 2 were largely unaffected. However, the river elevation dropped substantially at the location for Method 3, and the location for Method 4 was completely scoured of all vegetation. The mainstem of the river altered its course during the flooding events and now flows directly against the rock levee. This resulted in access issues that were compounded by safety issues. Further maintenance will be performed when the site is accessible.

**PURPOSE:** To evaluate four different types of Arundo eradication techniques. The real cost and methodology data generated by the project would then allow for effective planning and implementation of future Arundo removal projects within the Ventura River watershed, and ultimately throughout other watersheds in Ventura County. In addition to eradication techniques, six different riparian revegetation treatments with native plant species were to be tested. The project also included a public outreach and education program to heighten awareness regarding the ecological benefits of Arundo removal.

**METHODOLOGY:** The project site was divided into four sections, with a different eradication technique applied to each section. These techniques included Cut & Paint within a 0.50-acre area, Foliar Herbicide Application within a 0.25-acre area, Above-Ground Biomass Removal within a 4-acre area, and Total Excavation of biomass and root mass within a 0.25-acre area. All removal activities were completed mechanically using hand-held equipment. A small "Bobcat" was used to transport cut material from the stream channel to the staging area, and a hydraulic boom lift was used for the foliar application. Giant cane removed included any cane attached to existing sub-surface root mass, both living and/or dead. Unattached cane and native vegetation were not removed from the project site. Cut cane was stockpiled in a designated staging area and chipped to no greater than 4-inches in length. Chips were spread within the staging area at a minimum depth of 6-inches, and no greater than 12-inches.



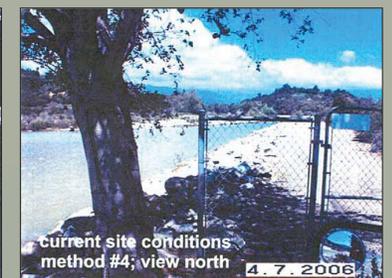
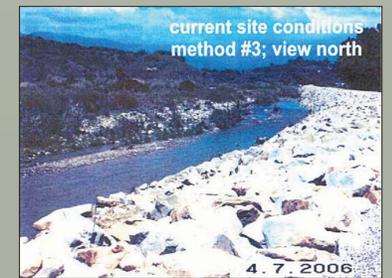
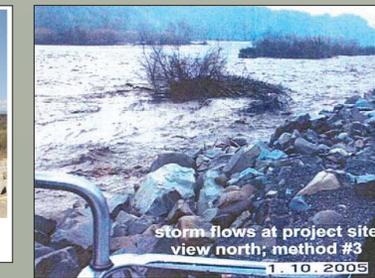
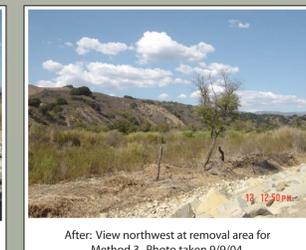
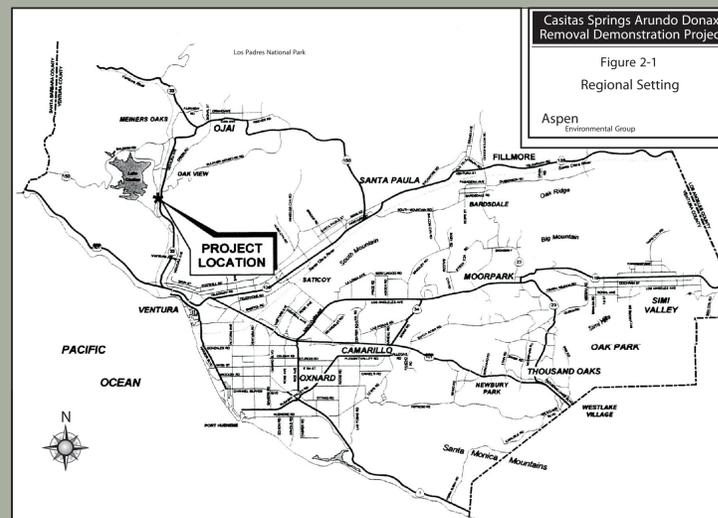
**Method 1: Cut-Stump Application of Herbicide (Cut/Paint) & Biomass Removal**  
Mechanical removal of the *Arundo* biomass immediately followed by the painting of the cut stumps with herbicide at appropriate cut-stump concentrations (50% to 100% volume-to-volume [v/v]).  
**Advantage:** Minimal resprouting compared to other methods, and lower post-removal maintenance costs.  
**Disadvantage:** Higher initial costs.

**Method 2: Foliar Application of Herbicide**  
Foliar spray application of the *Arundo* biomass at a concentration of approximately 1.5% to 6% v/v and then letting the biomass remain on site until dead. The dead materials would then be removed mechanically in the following spring with hand held equipment.  
**Advantage:** Lower initial costs than Cut & Paint method.  
**Disadvantages:** Dead material left on-site may become a fire or flood hazard. Labor involved in after-the-fact removal of dead material increases actual project costs considerably.

**Method 3: Biomass Removal Only (No initial herbicide application)**  
Removal of the above-ground *Arundo* biomass mechanically with hand-held equipment without applying any herbicide and subsequently treating regrowth with an herbicide, as appropriate, as it emerges.  
**Advantage:** Lower initial costs due to lack of herbicide application.  
**Disadvantages:** Immediate and frequent applications of herbicide become necessary shortly after biomass has been removed due to aggressive resprouting.

**Method 4: Hand Removal of All Vegetative Matter (Including root systems)**  
Mechanical removal of *Arundo* biomass, including excavation of the root mass, followed by monitoring and hand removal of regrowth, including root mass removal.  
**Advantage:** No herbicide application is necessary.  
**Disadvantages:** Labor involved quickly becomes cost-prohibitive in most cases. This method may also trigger additional permitting requirements and associated erosion problems.

Method 1 Actual Work: 5 Ac. Actual Cost: \$9,565 9,565 x 2 = \$ 19,130/ Acre @ 65% Density		Method 2 Actual Work: .25 Ac. Actual Cost: \$4,722 4,722 x 4 = \$18,888/ Acre @ 95% Density		Method 3 Actual Work: 3.75 Actual Cost: \$28,005 28,005 x .27 = \$7,561/ Acre @ 40% Density		Method 4 Actual Work: .25 Ac. Actual Cost: \$3, 474 3,474 x 4 = \$13,896/ Acre @ 2.4% Density	
Density	Cost/Ac	Density	Cost/Ac	Density	Cost/Ac	Density	Cost/Ac
65% (Actual)	\$19,130	95% (Actual)	\$18,888	40% (Actual)	\$7,561	2.4% (Actual)	\$13,896
10%	\$2,943	10%	\$1,988	10%	\$1,890	10%	\$57,900
10/65 = 15385	\$2,943	10/95 = 10526	\$1,988	10/40 = .25	\$1,890	10/2.4 = 4.16666	\$57,900
25%	\$7,358	25%	\$4,971	25%	\$4,726	25%	\$144,750
25/65 = 38461	\$7,358	25/95 = 26316	\$4,971	25/40 = .625	\$4,726	25/2.4 = 10.416666	\$144,750
50%	\$14,715	50%	\$9,941	50%	\$9,451	50%	\$289,500
50/65 = 76923	\$14,715	50/95 = 52632	\$9,941	50/40 = 1.25	\$9,451	50/2.4 = 20.83333	\$289,500
75%	\$22,073	75%	\$14,912	75%	\$14,177	75%	\$434,250
75/65 = 115384	\$22,073	75/95 = 78947	\$14,912	75/40 = 1.875	\$14,177	75/2.4 = 31.25	\$434,250
90%	\$26,488	90%	\$17,894	90%	\$17,012	90%	\$521,100
90/65 = 1.38462	\$26,488	90/95 = 94737	\$17,894	90/40 = 2.25	\$17,012	90/2.4 = 37.5	\$521,100
100%	\$29,431	100%	\$19,882	100%	\$18,903	100%	\$579,000
100/65 = 1.53846	\$29,431	100/95 = 1.05263	\$19,882	100/40 = 2.5	\$18,903	100/2.4 = 41.66666	\$579,000



**Assumptions/Estimations:**

- SWPCP/SWPPP has been incorporated into each individual method (and for this project only) on an estimated basis.
- Road/Access ramp grading has been incorporated into each individual method (and for this specific project only) on an estimated basis.
- 15% contractor profit has been factored into each individual cost-per-method (for this specific project only).
- 5% contingency has been factored into each individual cost-per-method (for this specific project only).
- Future arundo removal projects will likely vary in cost due to: project access difficulties, right-of-way agreements, inflation, prevailing-wage rate requirements, distance from contractors' home offices, administrative costs, permitting and CEQA costs, profit margin allowances, and other potential variables.

Cost Comparisons					
	Method 1	Method 2	Method 3	Method 4	TOTALS
Engineers Estimate	\$13,080.00	\$6,990.00	\$44,640.00	\$14,490.00	\$79,200.00
Contractor Bid	\$9,245.00	\$5,550.00	\$57,620.00	\$5,725.00	\$78,140.00
Actual Costs	\$9,565.00	\$4,722.00	\$28,005.00	\$3,474.00	\$45,766.00
(Not factored in: Travel time and overnight accommodations @ \$10,000 ±)					
Estimations:					
SWPCP	10%	5%	80%	5%	
Road Prep	10%	5%	80%	5%	
Chipping	15%	0%	80%	5%	

Man Hour Calculations, September 2004						
Date	Method 1	Method 2	Method 3	Method 4	Chipping	TOTAL
9/14	43.28					43.28
9/15	97.75					97.75
9/16	20.62					40.12
9/20		19.5				24.5
9/21		24.5				49.6
9/22		16.3				91
9/23			33.3			94.25
9/24			91			82.29
9/27			98			98
9/28			105			122
9/29			46.25	27.5		113.5
9/30			11.7	15		83.35
10/1					102.63	102.63
<b>TOTALS</b>	<b>161.65</b>	<b>60.3</b>	<b>561.79</b>	<b>42.5</b>	<b>216.03</b>	<b>1042.27</b>