

Contra Costa County

DECISION DOCUMENTATION for VEGETATION MANAGEMENT on County Roadsides and Road Rights-of-Way

Date: February 3, 2017 (last revised on 11/29/18)

Department: Public Works Maintenance Division

Location: Unincorporated rural areas

Situation: Vegetation management along roadsides and road rights-of-way

Note that management decisions are site specific for roads. Not every management technique will work equally well at all sites and for all weeds, and the costs of each technique will vary depending on the site. The County has developed a flowchart to aid the decision-making process.

See the CCC General Pest Management Decision Tree for a summary of the decision-making process.

What are the management goals for these sites?	<u>To reduce fire risk:</u> The County is subject to the regulations of 8 separate fire districts. The following are the districts and the links to their regulations (if available): • Contra Costa Fire Protection District (ConFire) http://www.cccfpd.org/pdfs/WA-2-minimum-standards-17.pdf • Crocket-Carquinez Fire Protection District (regulations not apparent on website) • East Contra Costa Fire Protection District (same regs as ConFire) • Kensington Fire Department (same regs as Richmond) • Moraga-Orinda Fire District http://www.mofd.org/literature_196457/Exterior_Hazard_Abatement_Standards • Pinole Fire Department (regulations not apparent on website) • Richmond Fire Department http://www.ci.richmond.ca.us/DocumentCenter/View/38822 • San Ramon Valley Fire Protection District -- http://www.firedepartment.org/civica/filebank/blobdload.asp?BlobID=4207 The County manages to the most restrictive regulations of the 8 fire districts, which are described in the County's fire protection ordinance: Title 7, Division 722, Section 320.4.1 says, "No person who has any ownership or possessory interest in or control of parcel of land shall allow to exist thereon any hazardous rubbish, weeds, trees, or other vegetation that constitutes a fire hazard." Title 7 Division 722, Section 320.4.2.1 says, "The Fire Code Official is authorized to cause areas within 10 feet (3048 mm) on each side of portions of streets which are improved, designed, or ordinarily used for vehicular traffic to be cleared of flammable vegetation and other combustible growth." The Public Works Department tries to maintain an 8 foot strip, where practical, of vegetation-free ground (not including trees, shrubs, or landscaping) along each side of a road. Fire district regulations stipulate that vegetation management must typically be completed by May 1, and at the very latest by July 1, in order to avoid abatement notices from the local fire district. The May 1 deadline is a recent change and makes it more difficult for the crew to perform all the needed work between the time that weather conditions permit work and May 1. <u>To maintain road safety:</u> The County maintains road safety in accordance with the County's best management practices. The following are some of the management practices: • Prevent sight line obstruction of signs, pullouts, ditches on sides of the road, obstacles on sides of the road (California Streets and Highways Code, Sections 1480-1485) • Prevent a perceived narrowing of the roadway from large plants growing close to the side of the road that can force drivers to move to the center of the road • Maintain adequate road drainage (vegetation can clog ditches and drains) • Keep pavement intact as long as possible ○ Plants next to pavement or growing into cracks in pavement can allow water to move down under the asphalt causing it to buckle and crack more. ○ Weeds growing along the shoulder can hasten the deterioration of the shoulder which can lead to hazardous roadside conditions, especially for bicycles, but also for cars if the drop from the road surface
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	becomes large. <u>To reduce liability for the County:</u> Fires, accidents, and law suits against the County are a regular and costly occurrence. <u>To prevent the movement of invasive plants along roadway corridors:</u> Invasive plant seeds and parts can be carried far and wide by animals, wind, and water moving along roadsides. Even vehicle tires and undercarriages, bicycle tires, and people's footwear can move weeds from one place to another. With these management goals in mind, the most appropriate management tactics are chosen based on cost, efficacy, impacts to the environment, public health, and other impacts to the public.
Who has jurisdiction over the areas in question?	The County owns the roads and rights-of-way and is responsible for their maintenance. The local fire districts are responsible for insuring that property owners and managers follow their regulations. Note: In general, in unincorporated areas where there are curbs, gutters, and sidewalks, the homeowner is responsible for vegetation management.
Number of road miles under management	The total number of road miles is 660 (a road mile includes both sides of the road). Approximately 325 to 375 road miles are under active vegetation management (the number changes with the weather and other factors from year to year). Not all of the 660 road miles are rural roads, many are in unincorporated residential areas where the Public Works Department does not manage roadside vegetation.
Number of staff available for vegetation management activities	Currently the Division has no Vegetation Management Supervisor; the position has been vacant for a year. There are 2 Senior Vegetation Management Technicians; both positions are vacant. There are 3 Vegetation Management Technicians; 2 positions are filled and the other is vacant. The 4 Maintenance Worker positions are filled.
Source of funding	Road maintenance, including vegetation management, is funded solely from the gasoline tax. The County does not contribute any money from the General Fund except for a small amount going to specific drainage projects. The funds coming from the gas tax have been declining for years because the tax has not been increased, while at the same time cars have become much more fuel efficient. In addition, there are many electric vehicles on the road that pay no gas tax for maintenance of the roads on which they drive. With the passage of California Senate Bill 1 in December 2016, the County saw a much needed increase in funds for road maintenance; however, the extra funds must first go to bring the average Pavement Condition Index up to 80 or better. At present, CCC's arterial Pavement Condition Index is in the 60s. Thankfully, SB 1 sustained an attempt at repeal in November 2018. The following are the main provisions of SB 1: • \$0.12 increase in gasoline tax/gallon, with inflation adjustment • Increase to the Vehicle License Fee of between \$25 and \$175, with inflation adjustment, depending on the cost of the vehicle • \$0.20 increase in the tax/gallon on diesel • An increase in vehicle registration fee for 2020 and later model zero-emission vehicles of \$100 with inflation adjustment • The bill imposes various requirements on the department and agencies receiving these funds. The bill authorizes a city or county to spend its apportionment of funds under the program on transportation priorities other than those allowable pursuant to the program if the city's or county's average Pavement Condition Index meets or exceeds 80.
How often is the site monitored?	All sites in the county are monitored every few days. The Vegetation Management Supervisor spends part of every day inspecting roadways on a rotating basis. The road crews, the road crew supervisors, and the vegetation management crew are all trained to recognize vegetation issues on roadsides and road rights-of-way and to report them to the Supervisor. Monitoring information is recorded on the Vegetation Management Supervisor's Daily Report. If a new weed species is found, the Supervisor identifies and researches the weed. If he/she cannot identify the specimen, he/she consults the County Department of Agriculture. If a weed on the California Department of Food and Agriculture A-rated list is found, the County Agriculture Department is also consulted.
Weeds have been identified as the following:	Any species that can pose a fire danger or sight obstruction, including volunteer trees and otherwise desirable species, will be managed to maintain the integrity of the road and road shoulder. Key weeds are listed below. The list is continually updated as vegetation changes. Invasive species: • Yellow starthistle (<i>Centaurea solstitialis</i>) • Purple starthistle (<i>Centaurea calcitrapa</i>) • Russian thistle, or tumbleweed (<i>Salsola tragus</i>) • Kochia (<i>Kochia scoparia</i>) • Stinkwort (<i>Dittrichia graveolens</i>) • French broom (<i>Genista monspessulana</i>) • Pepperweed (<i>Lepidium latifolium</i>) • Tree of heaven (<i>Ailanthus altissima</i>) • Algerian ivy (<i>Hedera algeriensis</i>)

	• Himalayan blackberry (<i>Rubus armeniacus</i>) Other species: • Poison oak (<i>Toxicodendron diversilobum</i>) • Poison hemlock (<i>Conium maculatum</i>) • Mare's tail (<i>Conyza canadensis</i>) • Mustard (<i>Brassica</i> spp.) • Mallow or cheeseweed (<i>Malva</i> spp.) • Various grasses The Department does not have a specific invasive weed management program; however, the vegetation management crew is trained to look for invasives when they are out working.	
Are populations high enough to require control?	The Vegetation Management crew manages vegetation as necessary to meet the management goals noted above. At times, vegetation re-growth may be sparse enough and the fire risk low enough that a decision might be made to leave the re-growth alone.	
Are these sensitive sites?	Are any areas “highly sensitive sites” as defined by PWD Environmental staff? A highly sensitive site contains a known habitat for, or is close to sightings of, endangered or threatened species. Refer to the attached flow chart for an outline of how sensitive sites are determined and handled.	No
	Are any areas under the Routine Maintenance Agreement with Fish and Wildlife?	It's possible if a road shoulder is under the riparian canopy.
	Are any areas part of the court-ordered injunctions? (see: https://www.epa.gov/endangered-species/interim-use-limitations-eleven-threatened-or-endangered-species-san-francisco-bay) Some areas are included in the red legged frog injunction. The Department has a map of areas included in the red legged frog injunction. The injunctions specify buffer zones around designated habitat for certain species for particular pesticides, but they do not preclude the use of those pesticides outside the buffer zones.	Yes
	Are any areas known or potential habitat for any endangered or threatened species? Some areas border habitat or potential habitat for species, but the actual gravel road shoulder is not suitable habitat for most vertebrates.	No
	Are these areas places where people walk or children play? Most of the roads and rights-of-way covered by this document are not suitable for pedestrian traffic or for children to play. Areas where people walk are the following: • Iron Horse Trail • Clyde Pedestrian Path • Delta De Anza Trail (county only maintains a small portion)	Occasionally
	Are they near an above ground drinking water reservoir?	Yes, some
	Are they near crops?	Yes, in some cases.
	Are they near desirable trees or landscaping?	Yes, occasionally
	Is the soil highly permeable, sandy, or gravelly? Yes, in some areas. Hoffman Road is one.	Yes
	Is the ground water near the surface?	Unknown, other than Hoffman Road
	Are they within a Groundwater Protection Area?	No
	Are they within an infiltration basin?	No
What factors are taken into account when determining the management technique(s) for vegetation?	• Species of plant • Stage of growth • Plant density • Plant location (accessibility, topography, adjacent properties) • Weather (precipitation, wind, temperature, relative humidity) • Road condition—if a road is in very poor condition, vegetation growing close to the edge can cause more	

	damage than if a road is in good condition. Every 7 to 10 years, the road is scheduled for resurfacing and there must be a clear corridor for the work. • Personnel available to perform the management activities when they are needed • Safety (for the public, staff, wildlife, adjacent property, the general environment) • Proximity to water resources and wildlife • Aesthetics of the site • State and local regulations • Budget available
Are special permits required for work?	If the Department were to use Vanquish (dicamba), which is restricted because of volatility, it would need to file with the County Department of Agriculture a Notice of Intent (NOI) to apply the material. Note that the Department has not used Dicamba in 5 years.
Which cultural controls were considered?	Mulching • It is difficult to contain mulch on the side of the road. There is a danger that it could clog drainage ditches and drains, run off into waterways, present road hazards to bicyclists. • Wood chip mulch is combustible and would only add to the fire danger. • The cost of buying and/or spreading mulch along roadsides would be prohibitive and very dangerous for the crew. Weed Barriers • Rubber mats can be used around guard rails, but are very expensive. Weeds can grow up through the joints in the mats and on top of the mats in accumulated soil and organic matter. Rubber mats are combustible, and the resulting fire releases noxious fumes. • Fabric barriers are expensive and very costly to install, hard to anchor to the ground, and vehicles can tear them, rendering them ineffective. • Weed seeds can germinate in the organic matter that accumulates on the weed barrier or is intentionally placed there. Planting Desirable Species • This has been used in some limited circumstances in Yolo County, but these areas are still managed with mowing, burning, and spot applications of herbicide. • Establishment takes time, money, water, and attention. • The plants must conform to very limiting specifications so as not to be sight hazards, fire hazards, etc. They could not be planted adjacent to the road. CONCLUSIONS: Mulching and weed barriers are problematic on roadsides. The Department has not found any areas where these would be appropriate. Planting desirable species is not used at this time because the Department must maintain a vegetation-free zone next to the road.
Which physical controls were considered?	Pruning: This is used on large vegetation where needed to meet management goals. Mowing by machine: Mowing is used on French broom to reduce the amount of vegetation before herbicide applications. Mowing is also used for blackberries and for willows in place of, or before, herbicide treatment. Mowing on the Iron Horse Trail is contracted out. Machine mowing is not used more extensively because of the following: • Terrain is a limiting factor. Many of the County's rural roads have unimproved shoulders that are very uneven and have trees growing on them. This makes mowing very difficult. • Mowing may not meet fire regulations in many areas. • Mowing in areas with threatened or endangered species can kill these creatures. • Mowing usually requires more than one pass per treatment which increases cost. Depending on the terrain, it may take several passes per treatment to mow down the vegetation. • With mowing there is always the risk of starting a fire when mower blades create sparks from striking rocks or other obstacles. This is a regular occurrence with both machine and hand mowing. • Recent changes in safety regulations for mowing have increased costs and the number of staff needed for each mower. This may have the effect of further limiting the work window. • Mowing can also transport invasive plant seeds and parts from one area to another. • There is a narrow window of time when mowing is most effective for meeting fire regulation deadlines. This is the same window of time in which flood control channels must be mowed. If mowing is done too early, the vegetation can grow back and require mowing a second or even third time to meet fire regulations. The Department does not have enough crew and equipment to complete all work by mowing in that space of time. • It is more costly than herbicide treatment. See Table 1 below. • The County's Climate Action Plan requires a reduction in greenhouse gas emissions, and increasing mowing would substantially increase those emissions.

	Mowing by hand: This has limited use on roadsides, but it can be useful around guard rails. • Mowing by hand (weed whacking) can be particularly dangerous for employees: ○ Traffic presents serious hazards. ○ Workers can sustain injuries from slipping on steep or rocky terrain. ○ Workers can sustain injuries from debris being thrown up and onto workers: rocks, glass, barbed wire, pieces of metal and pieces of mower blades. • Hand mowing is even more costly than machine mowing. • There is always a risk of starting a fire. Grazing • Logistics and safety on the side of a narrow country road are very difficult. The liability to the County is high. • Grazing animals can distract motorists, which can be a danger to both the animals and motorists. The animals temporarily remove the emergency parking available on the shoulder. • Grazing is costly for this application, especially because grazing a narrow strip necessitates moving the animals frequently, which is expensive. (See Table 1) Burning: Besides being dangerous, this technique could not be used on roadsides because the Bay Area Air Quality Control Board would not allow it. Electrothermal weeding (Ubiquek): This method uses a probe carrying electricity at a high voltage (3,000 to 5,000 volts) and low amperage (0.5 to 2 amps) to heat plant tissue and kill both roots and above ground plant material. The probe must contact each individual weed. This method is more efficient than steaming or flaming weeds, but would be very slow compared to mowing by machine or hand. High voltage can be lethal, so the device is potentially dangerous to the operator. This method also poses a fire risk because of the intense heat at the point of contact with the plant that can produce sparks and small flames. Currently there have been no independent evaluations of this method. At this time, the Department does not consider this a viable tactic for use on roadsides. Steam weeding (Weedtechnics): This method works by sending water under pressure through a diesel boiler and then out through hoses to an application head. The water comes out at 205 to 218 degrees Fahrenheit. This method is slower than other weed management techniques (it appears that the applicator must drive around 2 mph to treat effectively). A new model (the SW3800KD) is advertised as killing weeds faster. It uses 30 L of water per minute, and with a 1000 L water tank (apparently the largest size available), staff would have to refill the tank about every ½ hour. This tactic should be considered as a contact-only treatment and should not be expected to kill underground portions of the plant. Treatment would have to be repeated periodically during the season. At this time, the Department does not consider this a viable tactic for use on roadsides. Concrete under guard rails or cement treated base for road shoulders: These treatments are long lasting, but very expensive. Currently the County is not installing any new guard rails or shoulders. It is quite difficult to make repairs to concrete slabs if they crack or erode. Once cracks form, weed seeds can sprout in the cracks. Repairing concrete or cement-treated base used on the road shoulder is also very difficult, especially if damage occurs at the edge from erosion. Everything must be torn out and replaced. See Table 1 for more information on costs. CONCLUSIONS: Pruning and machine mowing are used by the Department where they are appropriate. At this time, the other techniques are too dangerous, too costly, or not practical. The County continues to explore new tactics as they emerge.
Which biological controls were considered?	Biological controls are not applicable in this situation unless a particular invasive weed is the target, and it has an available biological control.
Which chemical controls were considered? For more information on pesticides listed here visit the National Pesticide Information Center (NPIC). This a joint project of Oregon State University and the US EPA. http://npic.orst.edu/ You can communicate with an actual person at 1.800.858.7378 or	During many years of research, experience, and experimentation, including consulting the literature, researchers, and colleagues about materials that are labeled for, and effective on, weeds in rights-of-way, the Division has chosen the herbicide options listed below. The Division continues to consult researchers and colleagues, as well as new literature, to identify new choices that may be more effective, more environmentally friendly, and of lesser human toxicity. Pesticides may potentially exhibit both acute and chronic toxicity. The Signal Words below refer to acute hazards. For information on chronic toxicity, contact NPIC (info on left). Herbicides and application methods are chosen that prevent or minimize the potential for drift and exposure to humans and wildlife. As with all weed control techniques, herbicides must be reapplied periodically to suppress weeds over the long term. Note that the Weed Science Society of America (WSSA) and the Herbicide Resistance Action Committee (HRAC) both create resistance group designations to help weed managers reduce the likelihood of creating resistant weeds. Every 2 to 3 seasons, the Division rotates herbicide active ingredients according to the resistance group designations from WSSA to limit the buildup of herbicide resistant weeds along the roadsides.

Possible herbicide choices (These product names are subject to change.)

Pre-emergent Herbicides

Esplanade, Gallery, and Resolute are pre-emergent herbicides that are used in the buffer zone next to the road to maintain bare ground. They each belong to a different resistance management group and are used in rotation to prevent herbicide resistance. The Division uses pre-emergent herbicides to reduce the amount of post-emergent herbicides that are needed.

Indaziflam (Esplanade®): This pre-emergent herbicide controls a broad spectrum of weeds if applied before germination. It does not generally control weeds after they have emerged. For maximum weed control, the herbicide needs to reach the soil surface and be activated by rainfall or adequate soil moisture. It is applied in the fall to control winter germinating weeds and in the spring to control spring germinating weeds.

Signal Word (indicates acute, or immediate, toxicity): CAUTION

Rate: 3 to 5 oz/acre

Timing: Before weeds sprout in either fall or spring near the time rain is expected.

Cost to apply (includes material cost): \$125/acre

Herbicide Resistance Management Group: 29

On Ground Water Protection list (b): potential to contaminate ground water, but not yet found in groundwater

Isoxaben (Gallery® S.C.): This pre-emergent controls certain broadleaf weeds.

Signal Word (indicates acute, or immediate, toxicity): CAUTION

Rate: 20 to 30 oz/acre

Timing: Before weeds sprout in either fall or spring near the time rain is expected.

Cost to apply (includes material cost): \$210/acre

Herbicide Resistance Management Group: 21

On Ground Water Protection list (b): potential to contaminate ground water, but not yet found in groundwater

Prodiamine (Resolute® 65 WDG): This pre-emergent herbicide controls grass and broadleaf weeds by preventing the growth and development of newly germinated weed seeds. Weed control is most effective when the product is activated by at least ½" of rainfall or irrigation, or shallow (1" to 2") incorporation before weed seeds germinate and within 14 days following application.

Signal Word (indicates acute, or immediate, toxicity): CAUTION

Rate: 1 to 2 lbs/acre

Timing: Before fall weeds or spring weeds germinate, and close to the time rain is expected.

Cost to apply (includes material cost): \$97/acre

Herbicide Resistance Management Group: 3

Post emergent (contact) herbicides

Glyphosate (Roundup® Pro Concentrate): Glyphosate is a systemic herbicide (it is absorbed into the plant and circulates to kill the entire plant) that will kill most types of vegetation—grass, broadleaf, vines, brush, etc. Roundup is used as a contact herbicide for emerged grasses on road shoulders.

Signal Word (indicates acute, or immediate, toxicity): CAUTION

Rate for spot spraying on roadsides using a boom mounted on a truck: 2 pts in 20 gal of water/acre

Rate for spot spraying by pulling hose with a handgun attached: 6 pts in 100 gal of water/acre

This method is used mostly for parcels where a crew must walk rather than drive.

Timing: Varies depending on the location, the weather, the weed growth, the work load

Cost to apply (includes material cost):

- \$135/acre for Roundup application from a boom mounted on a truck

- \$673/acre for Roundup application from a hose with a handgun

Herbicide Resistance Management Group: 9

**Enjoined for red legged frog

On Ground Water Protection list (b): potential to contaminate ground water, but not yet found in groundwater

Triclopyr TEA (Garlon® 3A): Garlon 3A is specific for woody plants and broadleaf weeds (but not grasses) and is used for spot treatments. It is usually tank mixed with Roundup.

Signal Word (indicates acute, or immediate, toxicity): DANGER (for eye damage to mixer/loader and applicator)

Rate for spot spraying on roadsides using a boom mounted on a truck: 2 to 4 pts in 20 gal of water/acre

Rate for spot spraying by pulling hose with a handgun attached: 4 to 6 pts in 100 gal of water/acre

This method is used mostly for parcels where a crew must walk rather than drive.

Timing: Varies depending on the location, the weather, the weed growth, the work load

Cost to apply (includes material cost):

- \$146/acre for Garlon 3A application from a boom mounted on a truck

- \$714/acre for Garlon 3A application from a hose with a handgun

Herbicide Resistance Management Group: 4

**Enjoined for red legged frog

	On Ground Water Protection list (b): potential to contaminate ground water, but not yet found in groundwater <u>Herbicides with both Pre- and Post-Emergent Activity</u> Chlorsulfuron (Telar® XP): Telar XP is both a pre-emergent and post-emergent herbicide for the control of many invasive and noxious broadleaf weeds. Warm, moist conditions following application enhance the effectiveness of Telar XP since moisture carries the herbicide into weed roots and prevents them from developing. Weeds hardened off by drought stress are less susceptible to this herbicide. Telar is used primarily for control of difficult broadleaf weeds such as pepperweed. Signal Word (indicates acute, or immediate, toxicity): CAUTION Rate: 1.6 oz/acre Timing: Before fall weeds or spring weeds germinate and close to the time rain is expected. Cost to apply (includes material cost): \$113/acre Herbicide Resistance Management Group: 2 On Ground Water Protection list (b): potential to contaminate ground water, but not yet found in groundwater Dicamba diglycolamine salt (Vanquish®): Vanquish is used selectively as a spot treatment for difficult to control broadleaf weeds but has not been used in the County for 5 years. It is registered for selective broadleaf and brush control and has both pre- and post-emergent qualities. Dicamba is a systemic herbicide that acts as a plant growth regulator and is a federally restricted material due to the potential for harm to non-target plants. It can volatilize when temperatures are high. A special permit must be obtained from County Ag, and the applicator must notify County Ag in advance of the application. If the application is cancelled, County Ag must be notified. Signal Word (indicates acute, or immediate, toxicity): CAUTION Rate: 1 to 2 pts/acre Timing: Best when weeds are small Cost to apply (includes material cost): \$95/acre Herbicide Resistance Management Group: 4 Not on any injunction list On Ground Water Protection list (b): potential to contaminate ground water, but not yet found in groundwater Aminopyralid (Milestone®): Milestone is a systemic herbicide with both pre- and post-emergent properties that controls broadleaf weeds without affecting grasses. Milestone is used for the more woody and thick-stemmed weeds on road shoulders. Signal Word (indicates acute, or immediate, toxicity): CAUTION Rate: 5 to 7 oz/acre Timing: Between fall and spring before seeds germinate, but it is a more flexible chemical because it also has contact properties Cost to apply (includes material cost): \$96/acre Herbicide Resistance Management Group: 4 Not on any injunction list On Ground Water Protection list (b): potential to contaminate ground water, but not yet found in groundwater Sulfometuron methyl (Oust XP®): This pre-emergent and early post-emergent herbicide controls many annual and perennial grasses and broadleaf weeds. The Department rarely uses this on roadsides. Signal Word (indicates acute, or immediate, toxicity): CAUTION Rate: 3.6 to 4.8 oz/acre Timing: Before or just after weeds germinate in the fall or spring. Cost to apply (includes material cost): \$95/acre Herbicide Resistance Management Group: 2 On Ground Water Protection list (b): potential to contaminate ground water, but not yet found in groundwater CONCLUSIONS: When the IPM process calls for the use of herbicides, the products described above are used where most suitable considering cost, efficacy, the environment, human communities, and resistance management.
Which herbicide application methods are available for these chemicals?	The Department's current equipment allows for 3 methods of application: • broadcast application or spot treatment from a boom attached to a truck • spot treatment from a handgun attached to a hose connected to a truck-mounted tank • and spot treatment with a backpack. Factors considered in choosing the method of application: 1. The size of the area to be treated a. If the area is large and requires a large quantity of herbicide, the large truck is used because it can hold more material b. If the area is small, and requires a small quantity of herbicide, the small truck may be used. c. If the weeds are limited and close to the road edge, the handgun may be used to spot spray from the cab of the truck.

	d. If a median island is being treated, a backpack sprayer would be used. 2. The amount of weed growth to be treated a. If weed growth is abundant, more herbicide will be needed and the larger truck would be used. b. If weed growth is less abundant, the smaller truck may be used. 3. The characteristics of the weeds/sites to be treated a. If cut stumps are to be treated, the squirt bottle would be used b. If a stand of poison oak 100 ft. from the road edge is being treated, the handgun and hose would be dragged to the poison oak. c. As noted above, if weed growth is limited and near the edge of the road, the handgun may be used. d. If large swaths of contiguous weed growth are to be treated, a truck, large or small, would be used. 4. The distance from a site where the truck can be reloaded a. There are a number of sites in the County where a Public Works truck could reload herbicide: Byron Airport; Brentwood, Martinez, and Richmond Corp. Yards; and fire stations. b. The distance of the work site from one of the reloading sites is taken into consideration when choosing the application method. c. It takes time and burns more fuel to drive back and forth to reload in the field d. The crew must carry undiluted product, which is more dangerous if there is an accident. 5. Safety a. The large truck is safer in the event of an accident. b. Not having to reload in the field is safer, since undiluted product is not being carried in the truck. c. Using a backpack on a median island is safer than dragging hose across the road. 6. Cost effectiveness a. For environmental reasons and for cost effectiveness, the minimum amount of pesticide needed to do the job should always be used. Therefore the application method should be carefully matched to the job. b. Driving back and forth multiple times to treat a site wastes time, money and fuel and should be avoided. CONCLUSIONS: The terrain, proximity to water, potential human or non-target exposure, kind of weed species, and goal of the treatment dictate the application method.
What weather concerns must be checked prior to application?	The Vegetation Management Supervisor takes into consideration the pesticide label and all site specific factors. Each day, the Vegetation Manager checks the weather when he/she arrives at work at 6:00 AM. Rain can prevent application of some herbicides because of the danger of runoff. For most pre-emergent herbicides, rain is needed after application in order for the herbicide to be effective. The Vegetation Manager must also consider wind speed (generally it should be <7 mph) and possible temperature inversions to avoid herbicide drift. Crews carry wind meters in their trucks. Crews measure and record weather factors prior to and during application. Excessive heat or cold makes plants shut down, and herbicide applications at that time could be ineffective. The Vegetation Manager uses these factors to write Pest Control recommendations for the crew to follow on the days that spraying takes place.
Cost Comparisons for various mgmt methods on both roadsides and flood control channels	See Table 1, below.
Changes in management methods since the previous iteration of this document	Since FY 12-13, the Department (as of 2018): • Decreased acres of roadsides treated with chemicals by 61% • Increased acres mowed on flood control channels by 25% • Decreased acres of access road shoulder and fenceline treatments by 37% • Decreased acres treated with chemicals on flood control banks by 92% • Increased acres grazed by goats by 151% • Decreased acres of aquatic chemical treatments by 31%
Recommendations from the IPM Advisory Committee	• Continue to review all vegetation management methods available for roadside rights-of-way considering efficacy, cost, impacts to the environment, and to the human community. • Encourage investigation into, and experimentation with, new methods. • Review this document every 3 years.

Table 1. Methods, Acres Treated, and Cost* for Vegetation Management along Contra Costa Roadsidess and Flood Control Channels, Averaged over Two Years (2016-2018)[§]

Vegetation Management Method	Avg # of Acres Treated	% of Total Acres Treated	Avg. Total Cost for all acres treated	Avg Cost/Ac	% of Total Cost for all acres treated	% Change in Total Acres Treated from FY 12-13
Chemical Treatment - Roads	714.5	48%	\$137,896	\$193	18%	-61%
Right of Way Mowing (mainly flood control facilities)	318	22%	\$348,856	\$1097	47%	25%
Chemical Treatment – Flood Control Access Roads	144.5	10%	\$50,065	\$346	7%	-37%
Chemical Treatment – Flood Control Banks	14.5	1%	\$7,467	\$515	1%	-92%
Grazing (flood control facilities)	240.7	16%	\$158,355	\$658	21%	+151%
Chemical Treatment - Aquatic Applications	41	3%	\$37,686	\$919	5%	-31%
Mulching (flood control fence-lines and access road shoulders)	0.65	0.04%	\$6,642	\$10,218	1%	-89%
Totals	1473.75		\$746,967			-31%

*Table lists the most accurate costs available and is not necessarily specific to roadsides. The cost figures above for each method include labor, materials, equipment costs, contract costs (for grazing), and overhead (includes training, permit costs, and habitat assessment costs). Licensing costs for staff members are paid by the individual and not by the County. The cost of the Vegetation Management Supervisor when he supervises work is not included in any of the figures but is comparable among the various methods.

[§]Table is updated each year in the IPM Annual Report. See cchealth.org/ipm.