

PAULA LANE PRESERVE GRAZING PLAN

Written for:

- City of Petaluma
- Sonoma Resource Conservation District
- Daily Acts



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STATE LICENSED CERTIFIED RANGELAND MANAGER (CRM) #73

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INTRODUCTION

Paula Lane Nature Preserve is located at 431 Paula Lane in Petaluma, Sonoma County, California (APNs 019-080-009, -010). The Project Area is 11.09 acres (Cover Photo); is located approximately 1 mile west of downtown Petaluma; surrounded by rural residential development and is bordered to the north by Sunset Drive and residential development; to the east by Paula Lane, residential development, and annual grassland; to the south by annual grassland, residential development, and Bodega Ave; and to the west by Petersen Lane, residential development, and annual grassland.

This grazing plan provides interim prescribed monitoring and management practices, until appended to the forthcoming natural resource management plan. This plan augments the 2013 Paula Lane Management Plan.

AGRICULTURAL PRESERVATION & OPEN SPACE EASEMENT

The Sonoma County Agricultural Preservation and Open Space District (“District”) acquired a perpetual conservation easement (“Conservation Easement”) over the preserve in 2012. At the time of the grant and acceptance of a Conservation Easement, special-status species, known to use the Paula Lane Preserve, included American Badger, (*Taxidea taxus*), a California Species of Special Concern. The Preserve is also important for numerous other wildlife species, including resident and migratory avian species that use the Preserve as a migratory wintering and breeding/nesting area as well as common amphibian, reptilian, and mammalian species that forage on the site. The Preserve is located in a historic agricultural area of Sonoma County and Petaluma, representing the remainder of the first farm on Paula Lane, settled in the late 1800s.

The Conservation Easement restricts the use of the Preserve to natural resource protection, habitat restoration and enhancement, recreational and educational uses, and agricultural uses. This grazing plan is intended to achieve natural resource protection and habitat restoration, consistent with the Conservation Easement. It is not intended for agricultural uses except where designated in the Building Envelope and/or Agricultural Area. In this location, livestock can be bred, raised, pastured, and grazed for the production of food and fiber. On all other aspects of the Preserve, the prescribed grazing regime provided here is for the purposes of maintaining and restoring habitat for native plants and wildlife and reducing fuels for fires (which displace wildlife).

BIOLOGICAL COMMUNITIES

On August 20 and October 17, 2019, WRA, Inc. performed a biological resources assessment at the Paula Lane Nature Preserve. The purpose of the assessment was to gather information necessary to complete a review of biological resources under the California Environmental Quality Act (CEQA). The report assessed the Project Area and immediately adjacent area for: (1) the potential to support special-status plant and wildlife species; (2) the potential presence of sensitive biological communities such as wetlands

or riparian habitats; and (3) the potential presence of other sensitive biological resources protected by local, state, and federal laws and regulations. Biological communities documented on the site in 2019 by WRA include 9.78 acres of undeveloped annual grassland dominated by *Avena barbata* and *Holcus lanatus*, plus approximately 0.77 acre of landscaped and developed land including two residences, and 0.54 acre of seasonal wetland habitat dominated by *Festuca perennis* with at least one obligate plant observed, *Lythrum hyssopifolia*.

In 2021, Sol Ecology on behalf of the City of Petaluma completed an updated site investigation to verify conditions on the property since the 2019 WRA report. Sol Ecology plant ecologists found extensive *Erodium brachycarpum*, an aggressive invasive plant species on north facing hillslopes on the site. This species was noted in the 2019 report, but not as a dominant plant type. Little to no burrowing mammal activity or badger digs were noted by the Senior Wildlife Biologist in this area despite similar soil conditions as other parts of the site. Notably thatch cover in this location was higher than the perimeter (which is mowed annually) and flatter terrain on the northern extent of the property. Likewise, many of the hydrophytic species observed in the seasonal wetland in 2019 were not found in 2021. High thatch cover in this area was also noted, as was the presence of a high number of invasive plant species. Given that 2021 is a drought year, higher thatch cover combined with ungrazed biomass can exacerbate drought conditions further by preventing moisture and sunlight from penetrating to the seed bank, thus preventing this species from developing in the spring and summer. As of spring 2021, the mapped seasonal wetland did not meet U.S. Army Corps of Engineer hydrophytic vegetation criteria due to the absence of these hydrophytic species.

PLANT SPECIES

Within the Preserve, dominant species include wild oats grassland (*Avena barbata*), velvet grass meadow (*Holcus lanatus*), and non-native grassland with other associated non-native grass species present at lower densities including soft chess (*Bromus hordeaceus*), Italian ryegrass (*Festuca perennis*), ripgut brome (*B. diandrus*), and brome fescue (*F. bromoides*). Native grass and forb species observed in this community includes willow herb (*Epilobium brachycarpum*), Spanish lotus (*Acmispon americanus*), cottonbatting plant (*Pseudognaphalium stramineum*), and coastal tarweed (*Madia sativa*). Several invasive non-native plants are increasing in numbers including foxtail (*Hordeum murinum*) and long-beaked stork's bill (*Erodium botrys*). Scattered coast live oak trees and coyote brush (*Baccharis pilularis*) are present within this community. Individual native oak trees within the community may be considered "protected trees" under the Petaluma Tree Ordinance.

GRAZING GOALS

The principal function of this grazing management plan is to reduce the biomass of exotic herbaceous plants that can negatively affect the desired habitat of protected species. Grazing can be highly effective in reducing overall herbaceous biomass, for fuel reduction, carbon sequestration and sensitive habitat protection and enhancement. Grazing strategies with more intensive grazing, i.e. higher density of

animals for a short period can help control infestations of undesired species, reduce fuels, while maintaining habitat for special status species.

INCREASE SOIL HEALTH & CARBON SEQUESTRATION:

- Implement prescribed grazing plan
- Encourage growth of desired perennial species
- Monitor residual dry matter (RDM) closely

PROTECT AND ENHANCE HABITAT FOR SPECIAL STATUS SPECIES:

- American Badgers, *Taxidea taxus*
- Various raptor species

PROVIDE A FIRE BREAK FOR SURROUNDING HOMES:

- Implement fire management practices through grazing and fire breaks

COMPLIANCE WITH THE CONSERVATION EASEMENT

- Provide for natural resource protection and habitat restoration throughout the preserve
- Maintain historical rural character of Petaluma farm
- Provide educational opportunities for the public through grazing
- Provide Agricultural Demonstration site within the designated Building Envelope and/or Agricultural Area

TERMS

Animal Unit (AU). An adult cow or an adult cow and her calf, referred to as a “cow-calf pair”, or simply a “pair” or the equivalent.

Animal Unit Month (AUM). The amount of forage that is needed to support one AU for one month. One AUM is equal to 1,000 lbs. of forage¹.

Available Forage. Total forage minus RDM.

Browser. An animal that feeds primarily on woody vegetation.

Forage. Vegetation eaten by browsing or grazing animals.

¹ Forage weights used for this definition are variable. Some range managers use 1,000 pounds of forage for one AUM, which accounts for wasted forage. Others use a lower rate based on actual consumption (26 pounds per day per AU) and apply a “grazing efficiency rate” to account for wasted forage.

Grazer. An animal that feeds primarily on herbaceous vegetation.

Grazing Capacity. The maximum number of livestock that can graze on a given site without adversely affecting range productivity, causing a decline in range condition, or resulting in other adverse impacts. Grazing capacity is expressed in pounds or tons of forage produced, often described in AUMs.

Intermediate Feeder. An animal that feeds by browsing and grazing.

Residual Dry Matter (RDM). The amount of herbaceous biomass that should be left at the end of the grazing season to provide suitable conditions for germination of the following year's forage crop and for soil protection. RDM should be subtracted from forage production estimates to determine available forage. Professional opinions as to appropriate RDM levels vary to some degree and are dependent on-site objectives. An economic objective aimed at producing the maximum amount of high-quality forage might differ from one aimed at providing specific habitat conditions.

Stocking Rate. The number of AUs present on a given area over a designated period.

Livestock Species

Factors that determine the livestock species best suited for the Paula Lane include management goals and objectives, local livestock availability, predation potential, and infrastructure needs. Management goals and objectives are most important in selecting animal species because different grazing animals prefer, and select for, different types of vegetation (Table 1).

Cattle. Cattle are the most appropriate species for grazing at Paula Lane because they selectively consume grasses rather than forbs. They can also be contained with minimum fencing and are not at predation risks.

Llama/Alpacas. Llamas and/or alpacas are an acceptable substitute for cattle if it is difficult to find a cattle lessee for such a small site. However, these animals are typically raised more like pets than livestock, and many are fed supplemental hay on a regular basis.

Sheep. Sheep tend to target forbs, and are more likely to graze forbs than grasses.

Goats. Goats are primarily browsers, and like sheep, they target brush, then forbs.

Table 1 Generalized dietary preferences by domestic livestock species

Species	Dietary Preferences
Cattle	Grazer: mostly grasses, minor forbs and browse

Horses	Grazer: mostly grasses, minor forbs and browse
Sheep	Intermediate feeder: high use of forbs, but also use high volumes of grass and browse
Goats	Browser to intermediate feeder: high forb use, but can utilize large amounts of browse and grass; highly versatile

Soils

The NRCS Web Soil Survey identified two soil units on the Paula Land property; a variety of fine sandy loams, with vary degrees of slope (Figure 1). Soil acreage is listed in Table 2.



FIGURE 1 PAULA LANE PRESERVE SOILS MAP

Table 2. Soil Types on Paula Lane Preserve

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CtC	Cotati fine sandy loam, 2 to 9percent slopes	6.0	61.6%
CtD	Cotati fine sandy loam, 9 to 15percent slopes	3.8	38.4%
Totals for Area of Interest		9.8	100.0%

PRESCRIBED GRAZING

Prescribed grazing practices are designed to protect natural resources on-site and improve habitat conditions by reducing biomass and thatch to allow penetration of sunlight and moisture to perennial plants, increase plant diversity and habitat for pollinator species, reduce the spread of invasive plant species, allow access to forage habitat (burrowing small mammals) by American badger and raptor species, and reduce biomass for wildfire events (which can displace wildlife).

Prescribed grazing practices are also designed to improve the natural resources and/or habitat by improving grassland condition and productivity, which is expected to increase soil carbon stocks over time. This process generally involves planning both pasture grazing periods and rest periods to meet long-term management objectives, as pasture conditions and infrastructure allow. Successful grazing prescriptions often involve dividing pastures, thus reducing pasture size while increasing pasture numbers. Decreasing the number of herds on the ranch by combining herds where possible, can also facilitate this process, again by increasing the number of pastures that are rested from livestock use at any one time, and by increasing the length of the rest period between grazing periods.

The use of prescribed grazing will control the harvest of vegetation with the intent to achieve a specified objective. Grazing is used to maintain the desired level of forage to best suit the needs of the protected species. Changing the length of grazing periods and rest periods within a growing season is a key strategy to optimize forage production and utilization. As rapid forage growth begins in spring, grazing periods (time animals stay in each pasture) can be shortened. This accelerates the rotation, which leads in turn to fewer days of rest between grazing periods. Rest periods during the rapid growth period can be as short as three or four weeks, while grazing periods can be shortened to as few as three days, depending upon rate of forage growth, which is a function of soil moisture and soil temperature, and days of rest, which again depends on number and size of pastures, number of herds and herd size.

Ideally, livestock are moved rapidly enough to prevent grazing of plant regrowth within the same grazing period, which allows more rapid plant recovery from grazing impact and, ultimately, more total forage production. This approach also tends to favor perennial grasses, if adequate time for carbohydrate storage and foliage regrowth is allowed between grazing periods. Rapid early season rotation may allow complete deferment of grazing in some pastures, which not all may need to be included in the rotation at this time of year. This in turn enables “banking” of forage for later in the year, whether as standing forage in the field, or as conserved forage (hay, haylage, silage).

As forage growth begins to slow in late spring or summer, pasture rotations should also slow, and the time animals remain within a given pasture can increase, depending upon forage availability. Rest periods necessarily increase accordingly, so that by summer, periods of rest may be 90-120 days or more, assuming sufficient forage is available.

CARRYING CAPACITY

The forage is the basis of determining the carrying capacity of a given landscape and the subsequent stocking rate. The amount of forage grown on the land is a result of the precipitation zone, the soil type, landform position, elevation, and aspect. The abiotic factors determine the plant community composition or ecological site, and annual variability occurs due to precipitation timing and amount throughout the growing season.

Web Soil Survey (WSS) (<https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>) provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95 percent of the nation’s counties and anticipates having 100 percent in the near future. The site is updated and maintained online as the single authoritative source of soil survey information. Using the Web Soil Survey, Paula Lane’s soil map was generated to provide a detailed section of the soil types and the areas covered by each type on the ranch. The acreage for each soil type is used to provide an estimated grazing carrying capacity (Table 5).

Grazing capacity can then be estimated and stocking rates set based on site data and simple mathematical formulas. However, annual fluctuations in forage production mean that setting and adjusting stocking rates should be viewed as a process; adaptive management allows for the carrying capacity to increase or decrease based on the grazing season.

Based on the RDM standards for annual rangelands and utilizing estimated forage production per soil type for low, normal and high production years, the total carrying capacity of Paula Lane ranges from 6 - 18 cows for one month of grazing or 3 – 9 cows for two months, depending on the year’s forage production (Table 3). Cattle would graze twice a year, in late spring and either early spring or fall for two weeks at a time. Monitoring and other best management practices (BMPs) will be performed prior to cattle grazing

to locate and fence off any potentially occupied dens. Heavy thatch and dense invasive weeds (primarily *Erodium botrys*) form a thick carpet that reduces available forage habitat likely deterring badgers from establishing natal dens on the site during early spring (March to May); as observed in spring 2022. Once most annuals dieback, the site transitions to more suitable foraging habitat for badger (May to July). It is expected that once cattle grazing has been implemented and overall thatch reduced, there is a higher potential for maternal dens to occur at which point BMPs prescribed in this document will be necessary to ensure avoidance of occupied dens.

Currently there is no grazing occurring at the Paula Lane Preserve. Grazing recommendation is to begin at the lower range of the recommended stocking rate. At the end of the grazing season, the grazing should be evaluated and management adapted to meet grazing goals.

Table 3. Estimated* Annual Forage Production and Available Forage, Paula Lane Preserve, Petaluma, CA.

SOIL TYPE	SLOPE (%)	AREA (AC)	FORAGE PRODUCTION (LBS/AC/YR)*			RESIDUAL DRY MATTER (LBS/ACRE)	RESIDUAL DRY MATTER (LBS/ACRE X ACRES)	AVAILABLE FORAGE (FORAGE PRODUCTION – RDM)		
			Low Year	Normal Year	High Year			Low Year	Normal Year	High Year
CtC	2-9	3	1,500	2,250	3,000	750	2,250	2,250	4,500	6,750
CtD	9-15	3	1,500	2,250	3,000	750	2,250	2,250	4,500	6,750
Total		6						4,500	9,000	13,500
Animal unit months (AUM) (lbs. available forage/750** lbs./AUM***)								6	12	18
Animal unit (2 months)								3	6	9
† Data derived from USDA’s Web Soil Survey and regional guidelines published by the University of California Division of Agriculture and Natural Resources.										
*The amount of forage needed for one Animal Unit (one 1,000 lb. cow for one month). 1,000 lbs. * 2.5% forage per day * 30 days: 1,000 * 25 * 30 = 750 lbs. per month of forage required										
*** Carrying capacity is expressed in terms of “Animal Unit Months” (AUM). One AUM is equivalent to 1,000 pounds of grazing animal per month. An individual bull, two 500-pound stockers (steers or heifers), or a cow or cow-calf pair (calf under 6-months of age) are recognized to be equivalent to a 1,000-pound animal.										

GRAZING PLAN

Figure 1. Grazing Plan Fence Detail



FIGURE 2 PAULA LANE PRESERVE GRAZING AREA

SPECIAL-STATUS WILDLIFE

This grazing plan focuses on the American badger, *Taxidea taxus*, a CDFW species of special concern. However, there are a number of other special status species documented to occur in similar habitats in west Petaluma that may also occur on the Preserve. These species include:

- White-tailed kite (*Elanus leucurus*), CDFW Fully Protected Species
- Loggerhead shrike (*Lanius ludovicianus*), CDFW Species of Special Concern
- Grasshopper sparrow (), CDFW Species of Special Concern – note, this species was documented in 2020 within 5 miles of the site.
- Oak titmouse (*Baeolophus inornatus*), USFWS Bird of Conservation Concern

- Nuttall's woodpecker (*Picoides nuttallii*), USFWS Bird of Conservation Concern
- Burrowing owl (*Athene cunicularia*), CDFW Species of Special Concern; wintering only
- California red-legged frog (*Rana draytonii*), Federal Threatened – note, absence of suitable breeding habitat likely precludes this species currently. The addition of a permanent water source for cattle grazing may provide habitat for this species in the future.
- Western bumblebee (*Bombus occidentalis*), Federal Candidate – note, the historic range for this species includes all of Sonoma County. Invasive plants on the site likely preclude this species currently.

Of these, only oak titmouse has been recorded on the site. Many of these species are more commonly found in grazed grasslands with low thatch cover and/or native bunchgrasses. Prescribed grazing will improve habitat conditions for these species in the future.

The American badger is a CDFW species of special concern. The American badger occurs throughout California in drier open stages of most scrub, forest, and herbaceous habitats, which provide loose, gravelly or sandy soils suitable for burrowing. Badger burrows are constructed mainly in the pursuit of prey, but they are also used for sleeping. Dens may be as far as 10 feet (3 meters) below the surface and contain about 33 feet (10 meters) of tunnels. Badgers use multiple burrows within their home range, and they may not use the same burrow more than once a month. In the summer months they may dig a new burrow each day (Biological Resources Assessment, WRA, 2019).

In California, the primary prey items for American badgers are pocket gophers, ground squirrels, moles, woodrats, kangaroo rats, deer mice, and voles. They also prey on ground nesting birds, such as bank swallows and burrowing owls, lizards, amphibians, carrion, fish, hibernating skunks, insects, including bees and honeycomb, and some plant foods, such as corn and sunflower seeds. Badgers catch most of their food by digging and have been known to cache food (Long 1999). They contribute to natural ecosystems by consuming carrion and controlling populations of rodents, snakes, and insects, and their burrows provide shelter for other species (Long 1999).

American badgers are known to move up to 6 miles (10 km) a day in search of prey. On the central coast, badgers can have home ranges as large as 20 square kilometers with males having larger ranges than females. Badgers are primarily nocturnal and live at low population densities. Females are known to reproduce only every other year, with primary mating occurring in early winter and pupping in early spring. The association between females and young lasts from 10 to 12 weeks. Females may move their cubs to new dens within their home range after 4 to 5 weeks of pupping. On the Preserve, a number of potential natal dens were identified during the 2021 site assessment. Natal dens are characterized as larger and more complex than smaller overnight dens and/or digs. Many of these den complexes were found to be close proximity to smaller shrubs, including *Baccharis pilularis* and/or downed logs, which offer some screening from predators. These larger complexes are noted on the above map as Activity Centers and will be completely avoided using enclosures during prescribed grazing treatments.

Primary threats to American badger include changing land uses, increased nitrogen deposition, introduction of invasive plant and wildlife species, loss of prey (due to competition from domestic species, and/or rodenticides), fire suppression practices, vehicle strikes, and deliberate mortality by humans. Threats to this species have not been considered substantial enough to trigger federal or state listing as threatened or endangered, but CDFW has categorized them as Species of Special Concern. Managed grazing has been shown to combat anthropomorphic threats such as invasive species and nitrogen deposition and reduce reliance on other forms of fire suppression practices which threaten this and other special status species (Bartolome 2014). In 2010, the U.S. Fish and Wildlife Service (USFWS) reported in their 5-year review on San Joaquin kit fox (a federal threatened species which co-exists with and has the same habitat needs as the badger) changes to vegetation structure due to non-native species and altered grazing regimes is an additional threat to these species. In the same report, findings note that a reduction or cessation of grazing on sites where precipitation and soils allow growth of taller vegetation (over 18 inches) results in unsuitable conditions for kit fox (and other species) by reducing their prey base and/or increasing their risk of predation (USFWS 2010). While American badger is not at heightened risk of predation, in Sonoma County the species is more reliant on an ample prey base than elsewhere in California given the absence of ground squirrels. As such, a reduction or cessation of grazing regimes can significantly reduce and/or restrict the prey base for this species as badgers in Sonoma County require twice as many rodents (gophers, voles, and mice) to make up their diet as badgers found in the inland central valley (where ground squirrels are more abundant). Likewise, given higher rainfall and/or coastal drip in the region, the propensity for taller grasses is present and as such, some form of vegetation management is needed for this species to persist. Lastly, managed grazing has been determined to be a useful tool in combating climate change by increasing wetland function and soil saturability, which in turn benefits small mammal populations (Pyke & Marty 2005) that require a reliable water source.

GRAZING AND SPECIAL STATUS SPECIES RECOMMENDATIONS

In order to satisfy the current Conservation Easement, grazing practices is recommended:

- (1)** The property perimeter will be fenced with wildlife-friendly fencing, as outline in Figure 2; a temporary one-wire electric fence may be added to perimeter fencing as necessary to protect calves. The areas will be sub-divided if adequate water is available in each of the divided pastures. The use of temporary interior electric fencing will be used for better grazing distribution and to avoid any potentially occupied natal dens; electric fencing will be maintained to allow badgers to move freely underneath. Multiple pastures will allow for timed, seasonal grazing.

- (2)** Water source(s) will need to be provided to all pastures. A reliable water source must be secured before grazing can occur. The City will obtain District approval for the development of any water resources.

- (3)** The grazing period should be for 1 – 2 months each year, depending on precipitation and subsequent forage production. Adaptive management will be employed to ensure grazing avoids maternal natal dens, if present.

- (4)** RDM should be measured at the end of each grazing season utilizing the procedures outlined in the monitoring section below. If RDM levels are below the desired amount, i.e. 750 pounds per acre, grazing levels should be adjusted to ensure that RDMs is adequate to protect resources.

- (5)** Livestock utilization should remain flexible to accommodate variations in annual rainfall and other environmental conditions. Livestock number and season of use can be adjusted to manage vegetation height and density. Grazing distribution can be managed by using temporary interior electric fencing. Livestock grazing distribution to improve management of vegetation can also be controlled by adding water sources and/or placement of salt or supplement.

- (6)** Control of invasive species should follow the Integrated Pest Management (IPM) process. IPM employs a comprehensive set of procedures that optimally combines chemical, biological, and/or mechanical methods for effective pest control. This process maximizes protection of surface waters; minimizes pesticide use and maximizes use of “least toxic” chemicals while recognizing that quick and effective eradication of pests is a necessary result to minimize their spread and/or ecological impact; manages pests effectively using environmentally safe and cost-effective practices; and does not result in incidental take of special status species. The City of Petaluma is developing a citywide IPM program which will be implemented at the Paula Lane Nature Preserve when ready.

FENCING

Boundary fencing is essential for keeping livestock on site; cross fencing is important for distributing and managing livestock; enclosure or enclosure fencing is used to protect resources that might be damaged by grazing or to establish controls for monitoring purposes. Fencing proposed in this plan is designed to not impede badger or other wildlife movement. Fencing can be constructed from a variety of materials, including different types of wire; the type used should be appropriate for the kind and class of livestock and site considerations. For wildlife corridors, perimeter fencing at Paula Lane will be constructed per the Wildlife Friendly Fence Enclosure for Springs (Appendix 2). Other permanent perimeter fence will be comprised of 5-strand barbed. Even though only six acres inside the preserve will be grazed, it is recommended that a strong perimeter fence be built around the entire property. A temporary one-wire electric fence may be added to prevent calves from escaping; the additional electric wire will be placed inside the perimeter fence adjacent to the trail and/or public access points.

PERIMETER AND CROSS FENCING

To accomplish the goals outlined in this grazing plan, new perimeter fencing (4-strand wire, top and bottom wire smooth and the middle two wires barbed) should be installed. This fence design has proven to be friendly to wildlife (Paige, 2012). The spacing between strands should be 16 inches from ground-smooth wire; 22 inches from ground-barbed, 28 inches from ground-barbed wire; 40 inches from ground-smooth wire; a maximum height of 42 inches from the ground to the top of fence (Figure 3).

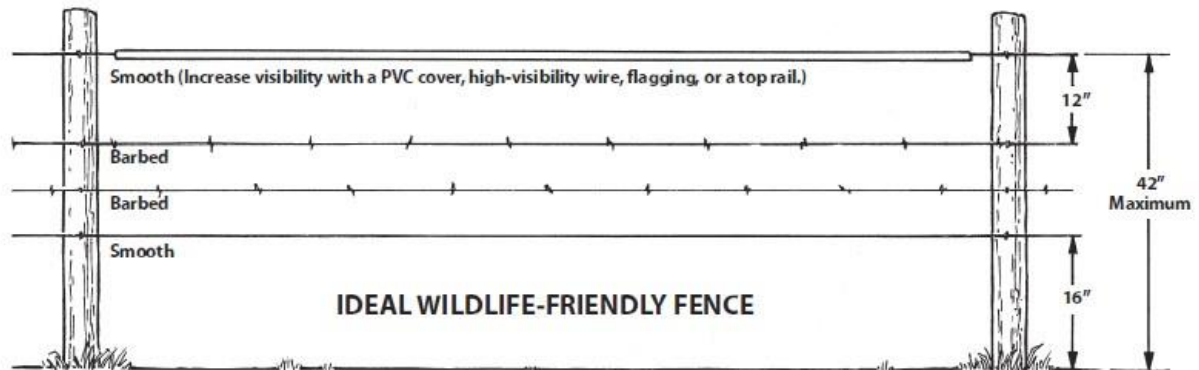


FIGURE 3 WILDLIFE-FRIENDLY FENCE

A perimeter fence will be built around the six-acre portion of the parcel that will be grazed (Figure 2).

All cross fencing will be temporary electric fencing. There will be no permanent cross fencing.

Residual Dry Matter

Residual dry matter (RDM) is the herbaceous plant material -living or dead- left standing or on the ground at the end of the grazing season (typically considered the beginning of October, or the start of the new water year). University of California Rangeland Monitoring Series Publication 8092 *California Guidelines for Residual Dry Matter (RDM) Management on Coastal and Foothill Annual Rangelands* (Bartolome et al., 2002) provides minimum RDM levels for California grasslands based on rainfall, slope, canopy cover and other factors. Adequate upland RDM should be maintained in the fall to protect the soil surface from erosion and to prevent degradation of grassland species composition, which can become dominated by weedy species such as thistles, if repeated excessive grazing occurs, leaving a high proportion of bare soil.

RDM measurement is commonly used to assess the year's grazing use on annual rangeland, whether moderate, excessive or light. The recommended standards are based on the observation that the amount of RDM remaining in the fall interacts with site conditions and weather to influence rangeland vegetation

species composition and forage production in the coming year. While annual rangeland RDM values vary from 500 to 700 pounds per acre on annual rangelands, the recommendations for RDM in this plan is 750 pounds per acre. (Table 4).

Table 4 Comparison of RDM Values - Annual Hardwood Rangeland -vs- Perennial Coastal Prairie

Woody Cover (%)	RDM standard for percent slope (lb/acre)							
	Annual Hardwood Rangeland				Perennial Coastal Prairie			
	0-10	10-20	20-40	>40	0-10	10-20	20-40	>40
0-25	500	600	700	800	1,200	1,500	1,800	2,100
25-50	400	500	600	700	800	800	1,200	1,400
50-75	200	300	400	500	400	400	600	700
75-100	100	200	250	300	200	200	300	350

While leaving appropriate amounts of RDM can appear to represent lost grazing opportunity in any given year, consistently low levels of RDM over time can be expected to result in gradual loss of soil organic matter and soil carbon, soil water holding capacity and rangeland productivity. Insufficient soil cover, whether live or dead material, can result in a downward spiral of declining rangeland condition. In this sense, RDM can be understood as an investment in the long-term productive capacity of the land, albeit at the “cost” of current season’s total grazing capacity. Because of the limited amount of site-specific research information, however, RDM standards normally must be developed using local experience and general guidelines, particularly on perennial pastures.

RDM is based upon a percentage of total annual above ground production. Thus, while total recommended RDM may decline from wetter to drier rangeland types, RDM, as a percentage of total production, should actually increase on drier annual rangelands. The long-term implications of reduced RDM should be considered when adjusting RDM targets downward, as reducing RDM as a percentage of total annual production will tend to drive a downward spiral of soil degradation, reduced water-holding capacity and reduced rangeland productivity over time.

RDM standards are guidelines and it is recommended that local guides be developed for the very reason that production varies on the same mapping unit and ecological site due to differences in weather and growing season length at a given location. Because production is so closely linked to prevailing weather other locations in the same ecological site can vary greatly in production. Thus, production estimates from the ranch should be used whenever possible. Monitoring of RDM can help determine these values are

correct over time. In this grazing plan, an RDM level of 750 pounds per acre was used in the carrying capacity calculations (Table 3).

GRASSLAND HABITAT CONDITION MONITORING

To achieve the goals of the Conservation Easement, the following practices are recommended for the grassland habitat areas outside the designated Building Envelope and Agricultural Area.

Annual monitoring should be conducted by a Certified Rangeland Manager (CRM) to assess the condition of the grassland. At a minimum, this monitoring should consist of the following:

- 1. Visual assessment.** General range conditions including residual dry matter, grazed non-native annual grassland species composition, invasive species, and any wetlands should be visually assessed.
- 2. Vegetation monitoring.** Vegetation monitoring will consist of RDM sampling to ensure that the grazing program is resulting in the desired level of biomass removal. RDM monitoring should be conducted annually in the fall, before the rainy season begins as described in Bartolome et al. (2002). The minimum target RDM level in the upland areas is 750 to 1,000 pounds per acre, which may be adjusted if conditions dictate.
- 3. Invasive species assessment.** Invasive species should be assessed and monitored to ensure that encroachment is not occurring. Ongoing monitoring for weed infestations, identification of problem species, and threat evaluation of newly observed species will be performed. Weed treatment methods will also be evaluated during these monitoring visits.

BEST MANAGEMENT PRACTICES (BMPS) FOR WILDLIFE

- **Surveys/Monitoring:** Prior to placement of cattle on the site, a survey of the entire Preserve will be performed by qualified biologists experienced in the identification of American badger natal dens and/or occupied dens. Potential natal/pupping dens shall be completely avoided until pups are fully weaned (after June 1). If a potential non-natal den is found, it (they) will be monitored daily for a period of at least 3 days consistent with the USFWS survey protocol for San Joaquin kit fox (and other ground-dwelling mammals such as badger). Monitoring will be conducted using track plates and/or camera monitoring daily.
- **Exclusion Fencing:** Electric cattle exclusion fencing shall be placed around any natal dens, or potentially occupied dens to prevent trampling by cows. The fencing shall be placed a minimum of 50 feet away from the den entrance and exit holes (a no-disturbance buffer of 100 feet shall be established for any natal den). Electric fencing shall consist of a single wire more than 2 feet off the ground to ensure badgers may pass freely underneath the fence.
- **Prohibitions:** Use of rodenticides and herbicides is prohibited anywhere on the Preserve.

- **Training Program:** An employee education program shall be conducted prior to cattle grazing. The program should consist of a brief presentation by a qualified biologist and include a description of areas requiring avoidance and BMPs prescribed.
- **Reporting:** If American badger is detected, a survey report shall be submitted to the California Department of Fish and Wildlife with details on the sighting for inclusion in the statewide California Natural Diversity Database.

ADDITIONAL MONITORING RECOMMENDATIONS

Compliance monitoring. Compliance monitoring includes stocking rate monitoring, grazing season monitoring, and RDM monitoring. The City will keep records of actual stocking rates and grazing periods so that resource responses to grazing levels can be accurately tracked and adjusted if needed.

Photo monitoring. While photographs cannot tell the entire story about a situation, project, or practice, much information can be gathered by comparing photographs taken of the same scene over a number of years. There are several kinds of photographs that you can take to document condition in a watershed or on a farm or ranch, including:

- landscape photos
- plot or close-up photos
- photos of wetland, or other special habitats
- event photos
- practice photos

These should give a representative view of the area and feature a distinctive landmark in the background (e.g., a peak, rock out crop, or ridgeline) to aid in taking follow up photos in the future. Be sure to include enough horizon in the picture to allow a future photographer to find the same photo point again. You can record large areas of bare soil, erosion, weed and shrub invasions and burns using landscape photos or they can be used to document ground cover, residual dry matter, erosion, endangered species, and weeds (McDougald et al., 2003).

GENERAL WEED MANAGEMENT

Successful weed management requires following a strategy that integrates appropriate management methods with the life cycle and ecology of target species. General weed management protocols that can be implemented include:

Ongoing Monitoring. Ongoing monitoring can simply consist of observations made and recorded by the landowners and grazing lessee.

Weed Identification. Weed identification should be confirmed, the threat posed by a new species should be evaluated, and appropriate weed management methods should be selected as described below.

Evaluation of Threat. The level of threat that each species poses should be evaluated. Highest priority species should be treated first.

Selection of Appropriate Treatment. The life cycle and biology of weed species and native and desired naturalized species should be considered in selecting the appropriate treatment.

Immediate Treatment. Isolated plants and small outlying populations should be immediately removed or otherwise treated to prevent establishment of new stands.

Control Before Flowering. Control measures should be implemented before flower maturity and seed set, or mature flowering or seed heads should be removed and disposed of.

Repetition of Management Measures. Management measures should be repeated as needed each season for plants with staggered maturities.

Most importantly, removal of newly introduced weeds should be aggressive, before they are allowed to spread and become well established. Single specimens or small patches of weed species that appear should be immediately removed and properly disposed of. Treatment success should be evaluated and prescribed treatments changed if necessary.

NON-GRAZING WEED MANAGEMENT TOOLS

Weed management methods other than grazing include the following:

Hand Removal. While hand removal of weeds can be labor intensive, it is the preferred methods for managing small patches of newly introduced weed species. Hand removal should be appropriate to the target species, and may consist of simple hand pulling of annual plants or hoeing small patches; digging up roots may be required for biennial or perennial plants.

Weeds removed by hand that are in a vegetative state can be left on site, while plants that are in flower, or that have ripe or unripe fruits should be buried or delivered to the landfill, to avoid spreading seed. Some plants, including thistles, which are pulled or cut when in flower can develop viable seeds after being removed.

Mowing. Properly timed mowing can be used to reduce seed output, especially with annual grasses, although mowing requires soil to be dry enough that a tractor can navigate through fields without getting stuck; this weed management method is typically only practical in very late spring and summer.

Flail mowers, which can cut as low as one inch, are the preferred type of equipment for removing the grassland canopy. Small areas can be cut using string trimmers, which are not limited by soil moisture conditions. However, weeds cut during the growing season often resprout, requiring repeat treatments.

Mowing may also be used as an interim method for grassland canopy management if implementation of grazing is delayed. Although mowing does not provide the same type of disturbance as grazing, cut herbaceous biomass may degrade at a faster rate than if it is left standing.

Chemical Treatment. When other methods are not effective chemical treatment should be used in compliance with the City of Petaluma’s IPM program. Herbicide treatment of serious weed problems may be warranted in cases where weeds that pose a significant threat to habitat values cannot be controlled by other methods.

Weed Burners. Use of weed burners or “flamers” is not recommended, due to low rates of success on plants beyond the very early seedling stage and fire hazard concerns during dry conditions. Weed burners are most effective in agricultural setting where seedlings that germinate within cultivated fields are flamed before seeded crops emerge.

FIRE BREAKS

Grazing of livestock will keep the risk of a serious wildland fire minimized on the Conservation Easement area; however, annual mowing of fire breaks may be necessary.

EMERGENCY RESPONSE

If an accident occurs at the Conservation Easement, the grazer will be contacted to take the necessary steps to secure the property and livestock. The Landowner will notify the City of Petaluma; the City will be responsible for making all repairs to fencing and habitat.

NATURAL RESOURCES CONSERVATION SERVICE PRACTICES

The Natural Resources Conservation Service (NRCS) assists landowners in establishing best practices for resource conservation and provides financial support in implementing these practices. Practices are associated with a variety of resources (soil, water, air, plants, animals and human), and each is assigned a number. NRCS staff work with landowners to identify resource conservation and land management goals and recommend practices to achieve these goals. The following are recommended NRCS practices to implement on Paula Lane to achieve the overall goal of increased production and management of forage, reduction of fuels, and improvement of special status species habitat (Table 5). Increased utilization of all pastures can occur through fencing, water development and grazing management.

Table 5. Natural Resources Conservation Service Practices

Goal	NRCS Practice Number	Description
<p>Maintain and increase forage production</p>	528	<p>Prescribe Grazing: Controlled harvest of vegetation with grazing or browsing animals, managed with the intent to achieve a specified objective. Improve or maintain animal health and productivity. Maintains or improves water quality and quantity. Reduces accelerated soil erosion and maintains or improves soil condition for sustainability of the resource.</p>
	382	<p>Practice facilitates the accomplishment of conservation objectives by providing a means to control movement of animals and people, including vehicles.</p>
	516	<p>Practice applies where conservation objectives require the addition of energy to pressurize and transfer water to maintain critical water levels in soils, wetlands, or reservoirs; transfer wastewater; or remove surface runoff or groundwater.</p>
<p>Provide adequate habitat for special status species</p>	612	<p>Establishing woody plants by planting seedlings or cuttings, by direct seeding, and/or through natural regeneration.</p> <ul style="list-style-type: none"> • Maintain or improve desirable plant diversity, productivity, and health by establishing woody plants. • Create or improve habitat for desired wildlife species compatible with ecological characteristics of the site. • Control erosion. • Improve water quality. Reduce excess nutrients and other pollutants in runoff and

		<p>groundwater.</p> <ul style="list-style-type: none"> • Sequester and store carbon. • Restore or maintain native plant communities. • Develop renewable energy systems. • Conserve energy. • Provide for beneficial organisms and pollinators.
Protection of water quality, improve habitat	528	Prescribe Grazing: Controlled harvest of vegetation with grazing or browsing animals, managed with the intent to achieve a specified objective. Improves or maintains animal health and productivity. Maintains or improves water quality and quantity. Reduce accelerated soil erosion and maintain or improve soil condition for sustainability of the resource.
	382	Practice facilitates the accomplishment of conservation objectives by providing a means to control movement of animals and people, including vehicles.
	516	Practice applies where conservation objectives require the addition of energy to pressurize and transfer water to maintain critical water levels in soils, wetlands, or reservoirs; transfer wastewater; or remove surface runoff or groundwater.
Increase length of grazing season	528	Prescribed grazing: Controlled harvest of vegetation with grazing or browsing animals, managed with the intent to achieve a specified objective. Improves or maintains animal health and productivity. Maintains or improves water quality and quantity. Reduces accelerated soil erosion and maintain or

		improves soil condition for sustainability of the resource.
	382	Practice facilitates the accomplishment of conservation objectives by providing a means to control movement of animals and people, including vehicles.
	516	Practice applies where conservation objectives require the addition of energy to pressurize and transfer water to maintain critical water levels in soils, wetlands, or reservoirs; transfer wastewater; or remove surface runoff or groundwater.

ADAPTIVE MANAGEMENT

Once a grazing plan has been instituted, it should be reviewed periodically and updated as new information becomes available or management objectives change. Information gathered through the monitoring program can assist in evaluating goals, enabling plan modification to improve future results. This is commonly referred to “adaptive management”, which was coined in the early 1970s. Adaptive management is the process whereby management is initiated, evaluated, and refined (Holling, 1978). The formal adaptive management process, as shown in Figure 3, consists of a six-step cycle that is a useful framework for vegetation management.

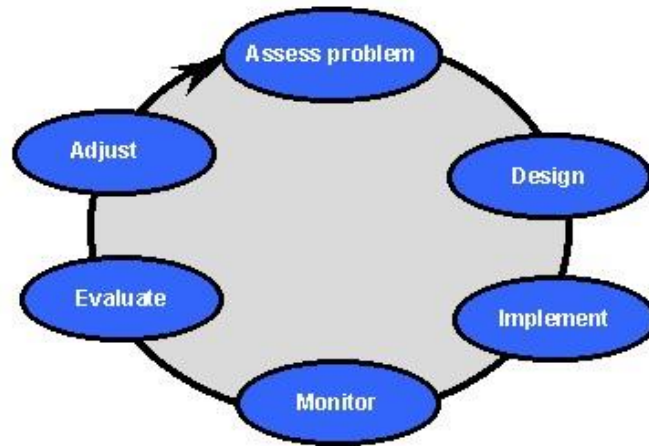


Figure 3. Adaptive Management Cycle

Figure 3 illustrates the six steps of adaptive management. These steps should be applied to this Grazing Plan as follows:

1. **Assess Problem.** Implement a grazing program, which uses cattle to manage habitat for sensitive status species.
2. **Design.** This step was accomplished in preparing this Grazing Plan as outlined in the goals and objectives identified.
3. **Implement.** The implementation of the grazing program to address the Conservation Easement Plan.
4. **Monitor.** Grazing should be monitored to maintain compliance with the Conservation Easement Plan. Monitoring can be conducted by a Certified Rangeland Manager.
5. **Evaluate.** Information gathered through monitoring will be used by the appointed entity to determine if the prescribed grazing methods are effectively meeting goals and objectives.
6. **Adjust.** Information gained in steps 4 and 5 will be used to evaluate and update, as necessary, the Grazing Plan to improve its results and management methods.

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APPENDIX 1 NRCS LIVESTOCK WATERING FACILITY SPECIFICATIONS

APPENDIX 2 WILDLIFE FRIENDLY FENCE ENCLOSURE FOR SPRINGS

APPENDIX 3 RESIDUAL DRY MATTER GUIDELINES, PUBLICATION UC
ANR #8092

APPENDIX 4 GRAZING RECORD SHEET & STUBBLE HEIGHT
WORKSHEET



*NATURAL RESOURCES CONSERVATION
SERVICE CONSERVATION PRACTICE
STANDARD*

WATERING FACILITY

Code 614

DEFINITION

A watering facility is a means of providing drinking water to livestock or wildlife.

PURPOSE

To store or provide designated access to drinking water for livestock or wildlife to:

- supply daily water requirements
- improve animal distribution
- provide a water source that is an alternative to a sensitive resource

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where there is a need for a watering facility for livestock or wildlife, where there is a source of water that is adequate in quantity and quality for the purpose, and where soils and topography are suitable for a facility.

CRITERIA

Capacity. Identify the type of livestock or wildlife that will be the primary user(s) of the facility. If the watering facility will supply water to different species of animals, provide sufficient water to meet the sum of the seasonal high daily water requirements of all the animals.

Refer to the National Range and Pasture Handbook (Chapter 6), State guidance, or university publications for information on livestock water quantity and quality requirements. For wildlife, base water quantity and quality requirements on targeted species needs.

User Needs. Design the watering facility so that access is adequate to accommodate the number of animals that will be drinking at the same time. Include design elements to meet the specific needs of the primary user(s).

Examples of specific design needs would include accommodation for antler size, species, and ingress and egress requirements.

Materials and Appurtenances. Construct the watering facility from durable materials that meet or exceed the lifespan of the practice.

Follow NRCS design procedures for the selected materials. Use industry standards where NRCS standards do not exist.

Stabilization of Disturbed Areas. Vegetate or stabilize areas disturbed by construction in accordance with the planned use of the facility. Use the criteria in NRCS Conservation Practice Standard (CPS) *Critical Area*

Planting (Code 342) to establish vegetation. If establishment of vegetation is precluded by site conditions, use the criteria in *NRCS CPS Mulching (Code 484)*, as appropriate.

Troughs and Tanks

Capacity. Design the watering facility with the storage volume necessary to provide water between periods of replenishment. Base the additional storage volume on the availability of water, replenishment rate, location, and planned operation.

Location. Locate the watering facility to meet the needs of the managed livestock or wildlife species. Select a site that will promote even grazing distribution and reduce grazing pressure on sensitive areas. Where multiple watering facilities are planned, place the watering facilities at distances that are appropriate for the species that will be managed.

When possible, locate the watering facility away from streams, ponds, or riparian areas to minimize chance of contamination from fecal contamination or surface pollution.

When a watering facility is installed adjacent to a well, provide positive drainage away from the well head.

Foundation. Install the watering trough or water storage tank on a firm, level foundation that will not settle differentially. Examples of suitable foundation materials are bedrock, concrete, compacted gravel and stable, well-compacted soils. Where necessary, prepare the foundation by removal and disposal of materials that are not adequate to support the design loads.

Anchor or brace the watering facility to prevent overturning by wind and animals, if needed.

Tanks. Analyze the foundation conditions and provide a design that will ensure the stability of the storage tank. For a vertical storage tank with a tank height greater than the tank diameter, also analyze the potential for overturning and identify the anchoring requirements.

Use NRCS design procedures or manufacturer's guidelines to ensure that buried tanks will withstand all earth and vehicle loads anticipated for the site.

Stabilization. For a fixed trough, protect the area around the watering facility where animal concentrations or overflow from the watering facility will cause resource concerns. Use *NRCS CPS Heavy Use Area Protection (Code 561)* to design the protection.

For a portable facility, move the trough frequently to prevent damage from animal concentrations.

Appurtenances. Use the criteria in NRCS CPS *Livestock Pipeline (Code 516)* to select the components needed to attach the water supply to the trough. Include backflow prevention devices on facilities connected to wells or to domestic or municipal water systems.

Provide a stable outlet for the overflow pipe when an overflow pipe is included in the design. Protect the outlet from damage.

Direct overflow from the trough to another beneficial use or to the original watercourse, where possible.

Where water is supplied under pressure to the watering facility, use an automatic water level control or float valve to control the flow of water to the facility in order to reduce energy use and prevent overflows.

As needed, install a float valve on a gravity-fed trough to avoid draining the water source. Protect valves and controls from damage by livestock, wildlife, freezing, and ice.

Escape Features. For a site west of the 100th meridian, incorporate escape features for wildlife into the design of an open-surface watering facility. For a site east of the 100th meridian, install escape features where local knowledge and experience indicate that wildlife may be at risk of drowning.

An effective escape device must:

- Meet the inside wall of the tank or trough
- Reach to the bottom of the trough or tank
- Be firmly secured to the trough rim
- Be built of durable material with a rough surface animals can grip
- Have a slope no steeper than 45 degrees
- Be located to cause minimal interference with livestock

Provide one escape device for every 30 linear feet of rim.

Refer to *Water for Wildlife – A Handbook for Ranchers and Range Managers*, Bat Conservation International, for additional information on escape features.

Watering Ramps

Where livestock or wildlife will drink directly from a pond or stream, use a watering ramp to provide a stabilized access to the water.

Evaluate the existing and proposed fences, grazing patterns, shoreline slope, and water depth when choosing the optimum location for the ramp.

Width. Make the ramp wide enough to accommodate the expected usage.

Length. Extend the ramp into the stream or pond far enough to achieve the desired depth.

Surface drainage. Divert surface runoff from the approach to the ramp.

Slope. Make the slope of the watering ramp consistent with planned animal usage but not steeper than 3:1.

Side slopes. Make all side slope cuts and fills stable for the soil materials on the site. Make the side slopes of cuts or fills in soil materials no steeper than 2 horizontal to 1 vertical (2:1). Make rock cuts or fills no steeper than 1.5 horizontal to 1 vertical (1.5:1).

Foundation. Where necessary, prepare the foundation by removal and disposal of material that are not adequate to support the design loads.

Surface material. Use the criteria in NRCS CPS *Heavy Use Area Protection (Code 561)* to design the ramp surface. The selected material must be of adequate quality to withstand underwater conditions.

Access. Use fencing or other barriers to delineate the boundaries of the ramp. Use NRCS CPS *Fence (Code 382)* for the design and construction of a fence. Barriers must be of sufficient size, strength, and quality to meet the intended use of the facility.

Ramps in Streams. Use the criteria in NRCS CPS *Stream Crossing (Code 578)* for the design and construction of a ford crossing except as noted above.

Locate the watering ramp so that it does not impede the movement of aquatic organisms in the stream.

Ramps in Ponds. A minimum water depth of 3 feet, measured from the designed permanent water level, is recommended. Where the pond depth is greater than 3 feet at the ramp location, it may be necessary to excavate the ramp into the pond bank to provide a stable base at the lower end. Extend the ramp a minimum of 0.5 feet above the designed permanent water level.

CONSIDERATIONS

Not all species need or benefit from supplemental water. Consider impacts to both target and non-target wildlife species before installation of a watering facility. Observed or documented use of a facility by wildlife does not necessarily indicate net benefits.

Introducing a new water source within an ecosystem can have effects such as the concentration of grazing, predation, entrapment, drowning, disease transmission, and expansion of the wildlife populations beyond the carrying capacity of the available habitat. Providing a water source for wildlife could enhance the habitat for species that compete with or prey on at-risk species.

Design fences associated with the watering facility to allow safe ingress and egress for area wildlife species. To protect species that access water by skimming across the surface, make fencing materials highly visible with appropriate openings. Add permanent streamers or coverings to wire fences that extend across a watering facility to make them more visible to skimmers.

Wildlife populations within desert or arid regions of the country can become dependent on supplemental watering facilities.

Consideration should be given to maintaining year-round water even if livestock is not present.

Consider designing the facility to benefit wildlife. Such designs would include providing ground-level access to water for species that cannot use raised structures such as troughs. Ground-level access can be provided through creation of an overflow collection area or a secondary ground-level water source.

Depending on the target species, planners may want to consider protecting these areas through the use of suitable fencing (marked as needed) that excludes livestock and larger wildlife species while allowing access of the site to small ground-dwelling species.

Consideration should also be given to prevention of disease transmission at watering facilities. Suitable controls/treatments for water-transmissible diseases and parasites should be considered if they are a problem locally.

When windmill, solar, or other potentially unreliable power source is used, supply additional daily water storage volume (3-5 days), provide a battery back-up system or provide an alternate water source. Use of a float valve on a system with one of these types of power supply may not be practical.

Consider the effects of water development on the balance or budget of water resources in the area of the new project. In some settings, this could be important and may result in effects to adjacent or associated habitats and species.

If there is the potential for small livestock, such as lambs or kids, to fall into the trough, provide a ledge or similar structure in the trough to provide an escape route or provide a second trough that has a shorter height.

Debris and algae can collect in watering facilities resulting in the need for frequent cleaning. Covers that shade the facility and reduce debris from falling into the facility, while still allowing animal access, will keep the water cooler, cleaner, and more palatable to animals.

When a roof is placed over the trough to provide shade, design the roof for appropriate snow and wind loads and ensure that it will be durable to withstand anticipated livestock and wildlife activities. Use the criteria in NRCS *CPS Roofs and Covers (Code 367)* to design the roof.

Where debris or algae is a problem, reduce the chances of clogging by increasing pipe sizes for inlets and outlets or by installing a feature such as an inverted elbow at the inlet to the overflow pipe. Maintenance of a watering facility can be made easier by providing a method to completely drain the watering facility. Protect the outlet of a drain from erosion.

Consider installation of a permanent means of ingress and egress for maintenance of a storage tank, if needed.

A watering facility located on a steep slope can have erosion problems from the animal traffic. The steep slopes may also cause problems with piping and valves from excess pressure. Choose the location of the watering facility to minimize problems caused by steep topography.

Watering ramps. Where livestock exclusion from a stream is part of the planned installation, consider installing a watering ramp that can be used if emergency access to water is needed. Use a gate to restrict access to the ramp.

The slope of the ramp can influence animal behavior. Steeper slopes tend to discourage loitering in the ramp area.

Select a surface material for the ramp that will discourage loitering but still provide a stable footing. The larger stone will make the hoof contact slightly uncomfortable.

Avoid locating watering ramps in shady places where possible.

It is difficult to put a fence in the middle of a stream. Where possible, extend the fence completely across the stream. Swinging gates can be used to restrict animal movement.

PLANS AND SPECIFICATIONS

Provide plans and specifications that describe the requirements for applying this practice to achieve its intended purpose. As a minimum, include:

- A map or aerial photograph showing the location of the facility and any associated pipelines
- Type and number of animals expected to use the facility.
- Special conditions for access, as needed
- Foundation stability requirements.
- Site-specific detail drawings showing the facility and necessary appurtenances (foundations, pipes and valves, escape features, anchoring, etc.)
- Requirements for stabilization of any areas disturbed by the installation of the facility
- Fencing, as needed
- Materials and quantities
- Construction specifications describing the installation of the facility

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan and review it with the operator. The plan will describe the actions that must be taken to ensure that the facility functions properly for its design life. As a minimum, include the following items:

- Regularly check for damage to the facility. Check for leaks, site erosion, and damage to fences, heavy use areas, and appurtenances associated with the watering facility. Repair or replace damaged components, as needed.
- Check the performance of the automatic water level device, if present.
- Ensure that the outlet pipe is freely operating and is not causing erosion.
- Regularly clean the facility.
- Maintain the facility to ensure that there is adequate inflow and outflow.
- Prepare the facility for winter as dictated by the climate. This may include draining supply pipes, emptying tanks, or ensuring that float valves will not be damaged by ice.
- For a portable facility, include the plan for moving the facility and for monitoring/repair of the areas around the facility.

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NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State office](#) or visit the [Field Office Technical Guide](#).

Fence – Wildlife Friendly

Conservation Practice 382D - Job Sheet

May 2012

DEFINITION

A constructed barrier to animals or people.

PURPOSE

This practice is applied to facilitate the application of conservation practices by providing a means to control movement of animals and people.

WHERE USED

This practice may be applied on any area where management of animal or people movement is needed. Fences are not needed where natural barriers will serve the purpose.



RESOURCE MANAGEMENT SYSTEM

Fish and wildlife structures are normally established concurrently with a management practice and with other practices as part of a Resource Management System (RMS) for a conservation management unit. Where a change in management alone will not address the wildlife concern, other practices are needed as part of a systems approach to addressing the resource concerns. For example where historic and/or current management practices have eliminated adequate shelter and cover for target wildlife, implementing additional practices can provide substitute cover and shelter until the plant community responds to that changed management. Installing nest structures can provide needed nesting and roosting sites for secondary cavity nesting species or other wildlife.

WILDLIFE CONSIDERATIONS IN PLANNING FENCES

This Job Sheet provides guidelines to design fences that meet both landowner objectives to protect property and manage livestock while reducing injuries to wildlife. Fences can injure and/or create a barrier to wildlife if not designed and installed correctly. Animals can collide or become entangled with fences, which frequently results in injury or death. Fences can also be barriers to animal movement that can limit access to important habitat resources

or separate young wildlife from adults. The level of risk a fence poses depends upon many factors, such as fence type, total height, wire spacing, visibility, and location on the landscape, wildlife species present, and season of wildlife use.

The most desirable situation for wildlife is a landscape without fences. However when fences are needed, it is best to incorporate “wildlife-friendly” elements into the fence design. Wildlife-friendly fences allow for safe passage of wildlife over or under fences and are highly visible especially to ungulates (hooved mammals such as deer and elk) and birds.

Fence – *Wildlife Friendly*

A number of fence design modifications can be made to improve conditions for wildlife. The vast majority of adult ungulate mortalities occur when animals get caught in the top two wires. Set the total fence height as low as possible. Keep in mind that the slope of the land increases the effective height of the fence. In most cases, a 40-inch tall fence on level ground with a minimum 12-inch spacing between the top two wires will be sufficient to prevent adult ungulate mortalities. Additional accommodations will be needed to allow for passage under the fence for animals like antelope and juvenile ungulates that prefer not to, or are incapable of, jumping over the fence.

Whenever feasible, use smooth wire for the top and bottom wires to reduce injuries.

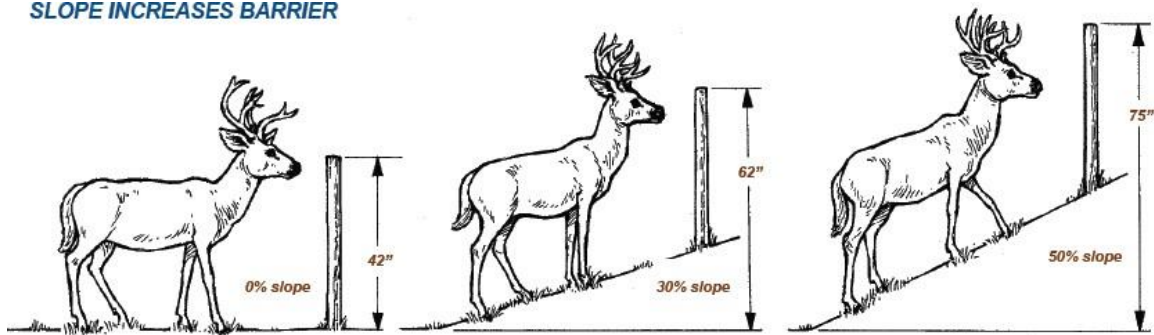
Increasing fence visibility will also help reduce wildlife injury and fence damage. Frightened ungulates, diving raptors, and low-flying birds like grouse and waterfowl frequently strike wire fences simply because they do not see them. Avoid placing fences in travel corridors or other areas heavily used by wildlife. If that isn't possible, several techniques are available to increase wire visibility, such as, slipping PVC pipe onto the top wire, using vinyl-coated white wire, or attaching durable flagging or other markers. Where wildlife concentrate, it may be more desirable to install segments of let-down or adjustable-wire fence to open up areas of fenced fields by temporary laid down segments of fence or wire to facilitate wildlife passage.

Planning Your Fence:

The primary purpose of the planned fence will direct its design and placement. However, it may be feasible to achieve the primary purpose while accommodating wildlife. The best scenario for wildlife and fences is that less is better. When planning a wildlife friendly fence consider the following items to meet your objectives:

1. Purposes of the fence: To protect your property, identify a boundary, keep livestock in or out, or keep wildlife away from the crop. Consider what type of animals (i.e. cattle, sheep, deer, and elk) you are trying to keep in or out? The purpose will help with the design and placement of your fence.
2. Topography: Are there hills, gullies, streams and water bodies in the planning area? Fences built on the contour of a slope actually increases barrier (fence) height making it more difficult to cross. The added height can create a barrier to wildlife or result in more injuries.

SLOPE INCREASES BARRIER



3. Species of wildlife present: What species (i.e. elk, deer, antelope, and or sage-grouse) will be negotiating this fence? What age group of wildlife will be in the area (i.e. adult and/or young)?
4. Movement Pattern: What is the daily and seasonal movement of wildlife and domestic livestock? Are livestock only present for 4 months out of the year? What time of year is the fence needed?
5. Presence of water, food and cover for wildlife: Wildlife will need food, water and cover on a daily basis. Fences that are not wildlife-friendly around streams, wetlands and water bodies may put ungulates and other large mammals at risk of injury on a daily basis. Fences close to sage-grouse leks or with poor visibility can kill grouse when they fly into them. If fencing is close to leks then raptor deterrents should be installed on the fence posts.

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Placement of fence is just as important as the type of fence being built. Do not restrict wildlife movement over the entire property. Where practical, avoid building fences across slopes. It is essential to provide for movement of wildlife close to important water, cover and food. Only use specialty barrier fences where needed like gardens, haystacks and corrals. For boundary fences allow free movement for wildlife including gaps and lay-down sections along known migration corridors when livestock are not present.

When fencing in areas where sage grouse are present do not install fences closer than 0.6 miles to a lek location. In areas where leks are present or bird and fence collisions have been observed improve visibility of wires by using reflective tagging.

Wildlife friendly designs for fences should be low enough that an adult can jump, high enough for the young to founder, minimize the chance of tangling and be visible to wildlife.

WILDLIFE FRIENDLY STRUCTURE ELEMENTS

The following wildlife friendly guidelines will fit several types of fences:

- Top wire/rail preferred height 40" or a maximum of 42" above ground.
- At least 12" between top two wires.
- Bottom wire preferred height 18" above ground or a minimum of 16".
- Smooth wire on the bottom.
- Posts at 20 foot maximum intervals.
- Keep wire tight.
- Make fence wire more visible by adding vinyl siding trim or small diameter PVC tubing to the top and middle wires. Flagging is not a first choice for making fencing more visible. Flagging needs to be replaced yearly and domestic and wildlife animals have been known to eat the flagging material.

CONSTRUCTIONS SPECIFICATIONS

GENERAL

Installation shall be in accordance with an approved plan. Details of construction shown on the drawings but not include herein are considered as part of these specifications. Construction activities shall be in accordance with applicable OSHA regulations.

Prior to construction the fence lines shall be cleared of any possible obstruction that would hinder the fenceplacement and operation.

The soil surface along the fence line shall be relatively smooth such that placement of the bottom fencing memberdoes not exceed the maximum fence member to soil surface spacing specified.

The fence materials shall have an expected life of at least 10 years with routine maintenance. All wood materials except Orange Osage, Western Red Cedar, Juniper and Black Locust that have contact with the soil shall be treatedwith an EPA-registered wood preservative. Wood posts shall be treated from the butt end of the post to distance ofat least 30 inches for line posts and 36 inches for all corner, gate and brace posts. Refer to Table 1 for the life expectancy of treated versus untreated wood posts.

Fence – *Wildlife Friendly*

MATERIALS

Wood Posts: Line posts shall have a minimum top diameter of 3 inches and shall be a minimum of 6 feet in length. Corner, gate and brace posts shall have a minimum top diameter of 5 inches and shall be a minimum of 7 feet in length. Braces shall have a minimum diameter of 4 inches and shall be a minimum of 8 feet in length.

Steel Posts: Steel line posts shall be the “T”, “U” or “Y” type with a welded or riveted anchor plate near the bottom (minimum 18 inches square area) and have suitable corrugations, knobs, studs or grooves for fastening the wire.

Line posts shall weigh at least 1.33 pounds per linear foot of length and shall be a minimum of 5.5 feet long.

Steel Pipe Posts: Steel pipe corner, gate or brace posts shall be a minimum diameter of 2 inches, Schedule 40 (2.375-inch O.D.) and at least 7 feet long. Bracing shall be a minimum of 1-1/2 inch nominal diameter, Schedule 40 pipe. Brace fittings and clamps shall be galvanized.

Angle Section Posts: Angle section posts shall have nominal sectional dimensions of 2.5 by 2.5 by 0.25 inches thick and at least 7 feet in length. Braces shall be of the same size dimensions as corner and gate posts and shall be a minimum of 6 feet in length.

Table 1: Life Expectancy of Untreated and Treated Fence Posts (Years)

Type	Un-treated	Pressure Treated	Hot and Cold Bath	Cold Soak
Western Red Cedar	12-15	20-25	20-25	-
Lodgepole & Ponderosa Pine	2-4	20-25	15-20	10-20
Aspen or Cottonwood	1-3	15-20	10-15	5-10
Douglas Fir & Western Hemlock	3-6	20-35	15-25	10-20

Vinyl Coated Wire: Vinyl coated wire (white in color), high tensile and a minimum of 12.5-gauge.

Smooth Wire: Smooth wire shall be a single steel wire of 9-gauge or heavier, two wrapped strands of 12.5-gauge or heavier wire or 12.5-gauge or heavier hi-tensile wire. Wire shall have a minimum tensile strength of 45,000 psi.

Barbed Wire: Barbed wire shall be composed of two strands of 12.5-gauge zinc coated wire wrapped around each other, with 2-point 14 gauge barbs spaced no more than 5 inches apart conforming to ASTM A 121.

Wire Fasteners: Staples shall be 9-gauge or heavier and have a minimum length of 1.5 inches, except 1.0 inch staples are allowed on very hard woods. Fasteners for use with steel posts shall be 12-gauge or heavier zinc coated wire.

Stays: Wire stays shall be 9.5-gauge or heavier, zinc coated, twisted wire. The length shall be at least two inches longer than the distance between the top and the bottom strands of the fence. Wood stays shall be sound, straight pieces at least 2 inches in diameter.

INSTALLATION

The fence shall be reasonably straight and shall not deviate more than 12 inches between any corner and gate or line brace assembly.

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Post Depth: Line steel posts shall be set a minimum depth of 1.5 feet and wood line posts shall be set to a minimum depth of 2 feet, unless otherwise specified. Gate, corner and brace posts shall be set to a minimum depth of 3 feet, unless otherwise specified. Steel pipe and angle section posts shall be embedded in a 12-inch circular or square concrete pier, except when set in firm rock.

Post Spacing: The maximum post spacing interval shall be 20 feet on fences without fence stays, 25 feet with one stay between posts, and 30 feet with two stays between posts.

Line Bracing: Line brace assemblies shall be located at all corners, gates and abrupt changes in vertical topography (generally considered as 15 degrees). On straight reaches of fencing line braces shall be installed at a spacing of no more than 1300 feet.

Wire Spacing: Distance from ground to top wire shall not exceed 42 inches (total fence height). A maximum height of 40 inches or less is preferred. The top 2 wires must be spaced at least 12 inches apart. The distance from ground to bottom wire shall be at least 16 inches.

EXCEPTION: If it is necessary to control sheep or calves with the fence, the ground to bottom wire spacing may be reduced to 10 inches as long as the total fence height does not exceed 32 inches.

Wire Type: Smooth or barbed wire may be used. In all cases, the bottom wire shall be smooth.

Wire Fasteners: Staples shall be driven diagonally into the wood grain of the post. Space shall be left between the post and the staple to allow movement of the wire. Fasteners on steel posts shall be snug enough to prevent vertical movement of the wire on the post.

Stays: Stays shall be uniformly spaced between the posts as required for the specified post spacing.

Drainageways: In crossing drainageways or depressions a weight or deadman anchor shall be fastened to the fence to maintain the required spacing interval or additional wires shall be added to maintain the required minimum wire height from the ground.

Wire Visibility: All new fences should be marked with at least temporary flagging. In travel corridors or areas of heavy use, implement one or more of the following to increase wire visibility: 1) use durable markers such as small pieces of white vinyl siding to mark wires, 2) use white vinyl-coated wire or other high visibility wire for top wire, or 3) slip sections of PVC pipe onto top wire.

If compatible with livestock management, it may be also be appropriate to install a section of let-down or adjustable-wire fence to facilitate heavy wildlife movement during seasonal use periods. Refer to Paige (2008) for designs.

OPERATION AND MAINTENANCE

Regular inspection of fences should be part of an ongoing maintenance program. Inspection of fences after storms and other disturbance events is necessary to insure the continued proper function of the fence. Maintenance and repairs will be performed in a timely manner as needed, including tree/limb removal and water gap replacement.

Monitor fences to ensure safe passage for wildlife. If problem areas are detected, measures should be taken to reduce or eliminate threats to wildlife.

Remove and properly discard all broken fencing material and hardware. All necessary precautions should be taken to ensure the safety of construction and maintenance crews.

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A wildlife-friendly fence should result in less maintenance due to reduced wildlife damage. However, regular inspection of fences should continue to be part of an ongoing maintenance program. Wires should be kept tight. Loose wires can snag wildlife and increase the likelihood of entanglement. Inspection of fences after storm events is necessary to insure the continued proper function of the fence. Maintenance and repairs will be performed in a timely manner as needed.

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Wildlife Friendly Wire Fence, Job sheet

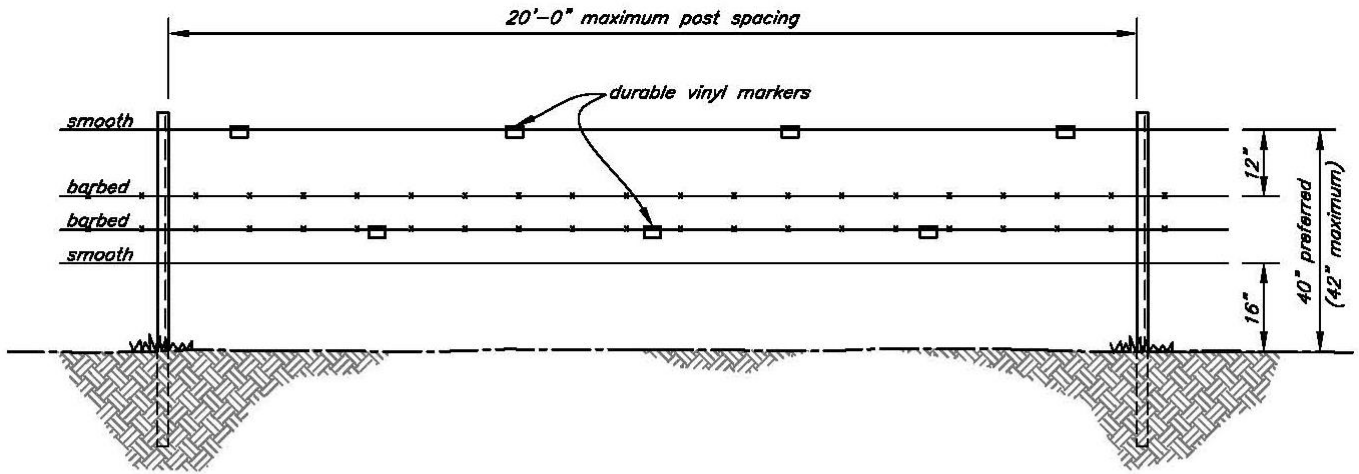
NRCS, OR, 2010. *Wildlife Friendly Wire Fence, Job sheet*

Fence – Wildlife Friendly

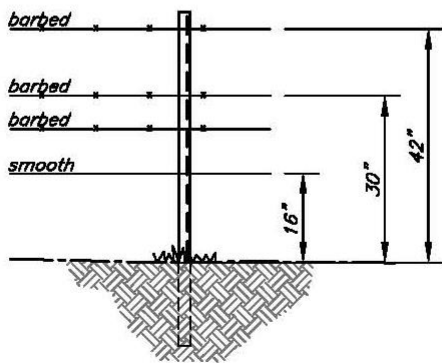
Conservation Practice 382D – Specification Sheet

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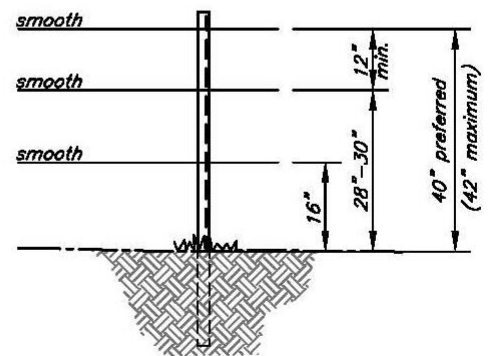
Standard Wildlife-Friendly Wire Fence Drawings



4-STRAND BARBED & SMOOTH WIRE FOR AREAS WITH LIVESTOCK AND WILDLIFE PRESSURE



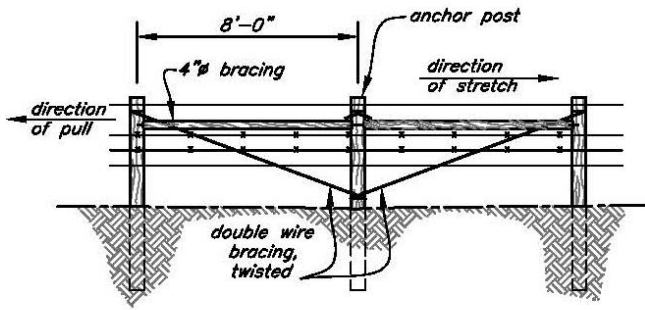
4-STRAND BARBED & SMOOTH WIRE FOR AREAS OF REGULAR LIVESTOCK PRESSURE



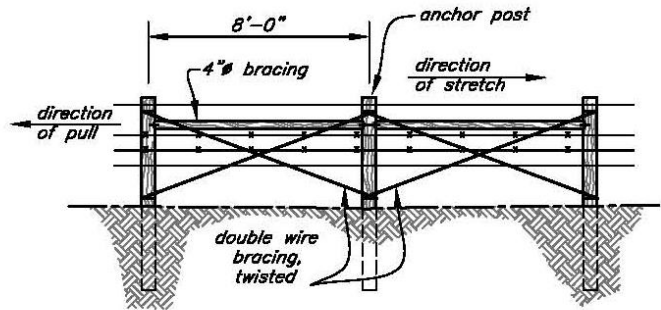
(for additional livestock control, used barbed wire instead of smooth wire on top 2 strands)

3-STRAND SMOOTH WIRE FOR AREAS OF LIGHT LIVESTOCK PRESSURE

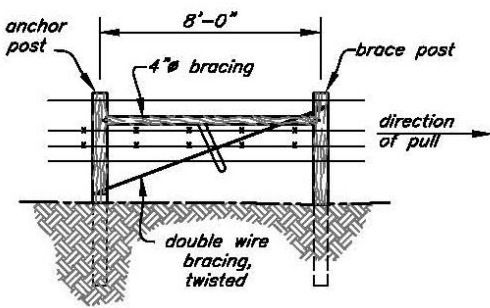
Fence – Wildlife Friendly



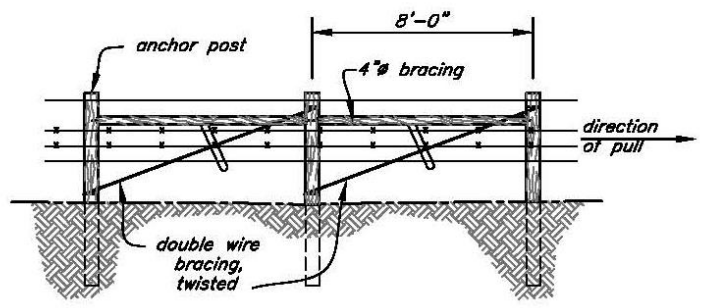
LINE BRACE



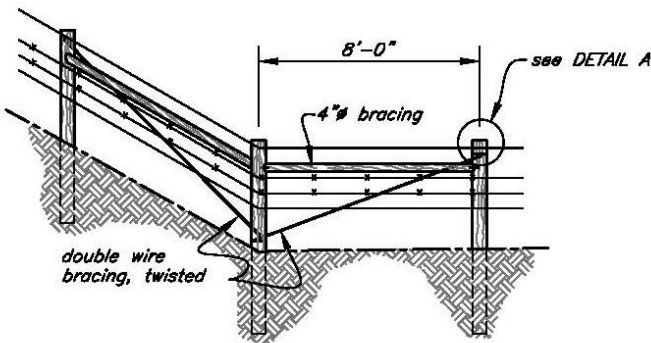
LINE BRACE



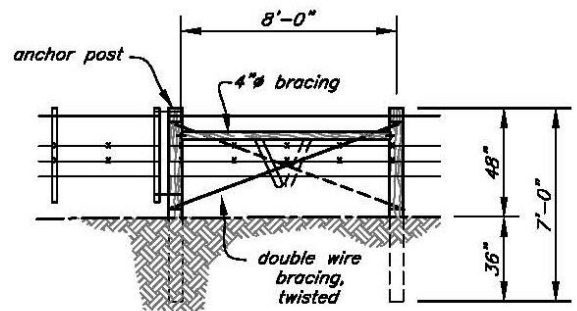
1-SPAN END



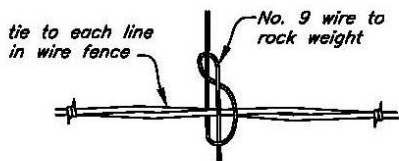
2-SPAN END



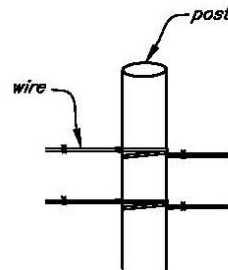
CORNER BRACE



GATE BRACE



TIEDOWN DETAIL



DETAIL A

1. Double wrap all bracing.
2. All brace posts to be 7' long, 3' embedment.
3. Dap braces into posts.
4. Spike braces to posts.

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Client:		Date:	
Location:		County/RCD:	
Contract #:		Tract/Field:	
Planner:		Acres:	

Wildlife to Benefit:	
Purpose:	
Location/ Spacing:	
Quantity/ Type:	
Dimensions:	
Materials:	
Timing of Installation:	
Operation and Maintenance:	
Conservation Measures	
Comments:	

DESIGN APPROVAL:

Design Approved by: /s/ _____

Job title: _____

Date: _____





Guidelines for Residual Dry Matter on Coastal and Foothill Rangelands in California

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Residual dry matter (RDM) is a standard used by land management agencies for assessing the level of grazing use on annual rangeland and associated savannas and woodlands (George et al. 1996). RDM is the old herbaceous plant material left standing or on the ground at the beginning of a new growing season. It indicates the combined effects of the previous season's forage production, breakdown over summer, and its consumption by grazing animals of all types. The standard assumes that the amount of RDM remaining in the fall, subject to site conditions and variations in weather, will influence subsequent species composition and forage production.

Properly managed RDM can be expected to provide a high degree of protection from soil erosion and nutrient losses. Applications of specific RDM standards based on a limited research base and on experience have demonstrated the effectiveness of this approach to grazing management. Because of the limited amount of research information, standards and score cards normally have to be developed using local experience and general guidelines such as those that appear in this publication. Numerous agencies have successfully applied the RDM-based method for managing grazing intensity over the past 20 years. Some examples are the Bureau of Land Management and the Natural Resources Conservation Service (BLM 1999), the National Park Service (Shook 1990), the U.S. Forest Service (USDA Forest Service 1997), and the San Joaquin Experimental Range (Frost et al. 1988).

REGIONAL GUIDELINES

A series of experiments conducted by H. F. Heady dating from the 1950s showed that the amount of fall RDM (or what Heady termed "natural mulch") dramatically influenced forage productivity and composition at the high-rainfall (35 in/yr, or 89 cm/yr) UC Hopland Research and Extension Center site in southern Mendocino County (Heady 1956). To determine the effects of RDM that would be representative of heavy to moderate grazing on annual rangeland at different sites, Heady established nine experimental plots in the late 1960s and early 1970s and maintained them for 3 to 5 years. They were arranged along a rainfall gradient from the North Coast (rainfall > 40 in/yr, or 102 cm/yr) along the west side of Central Valley to the driest annual rangeland in the Western San Joaquin Valley (rainfall < 7 in/yr, or 18 cm/yr) (Bartolome et al. 1980).

This study showed that RDM had a significant influence on rangeland productivity in areas with annual rainfall in excess of 15 inches (38 cm/yr), subject to the overriding controls of site conditions and annual weather. Maximum productivity within the 15- to 40-inch (38- to 102-cm) annual precipitation zone occurred with 750 pounds per acre (840 kg/ha) of RDM in fall. The effects on composition in Heady's experiment were mixed (Jackson and Bartolome 2002). However, the experimental sites constituted an incomplete representation of the annual rangeland region and were limited to flat ground without any woody plant cover. An ongoing experiment in the Sierra Foothills suggests that the range of 600 to 1,200 pounds per acre (672 to 1,344 kg/ha) of RDM maximizes both forage production and species richness (Bartolome and Betts 2005).

Clawson et al. (1982) developed regional guidelines for minimum allowable RDM based on the best available research information at the time. Subsequent experience and limited research suggest that those guidelines for RDM were probably too low for grasslands with more than about 12 inches (31 cm) of average annual precipitation.

McDougald et al. (1991) developed a scorecard that can be used to quickly estimate an area's grazing capacity. The scorecard was developed by combining site characteristics (rainfall, canopy cover, and slope) that affect animal use to quickly estimate grazing capacity. The scorecard approach can yield useful estimates of grazing capacity from a pasture or an entire landscape and is easily coupled to geographic information systems (GIS) to allow mapping of forage availability (Standiford et al. 1999).

For RDM management purposes, California grassland and associated oak wood-lands and savannahs can be divided into three types. Recommended minimum RDM guidelines for each type are listed in scorecard form in tables 1 through 3.

- *Dry annual grassland.* Annual plant dominated (grasses, legumes, forbs), with average annual rainfall less than 12 inches (31 cm). Oak or shrub canopy is typically less than in other types.
- *Annual grasslands/hardwood rangeland.* Annual plant understory with variable oak or shrub canopy, average annual rainfall between 12 and 40 inches (31 to 102 cm).
- *Coastal prairie.* Perennial grasses common, variable woody overstory, annual rainfall variable but commonly greater than 35 inches (89 cm).

These guidelines provide livestock producers and other rangeland managers with useful information for managing rangeland. They were developed to help managers assess the proper level of herbaceous forage use, and for this reason they do not include measurements of other vegetation such as oak leaves and summer annuals. Included in the category of summer annuals would be such plants as yellow starthistle (*Centaurea solstitialis*), turkey mullein (*Croton setigerus*), and tarweed (*Hemizonia* and *Holocarpha* spp.). While these plants and plant parts do provide soil protection, they do not figure into current livestock management and so are not included in these guidelines. If the goal were to assess site protection regardless of the type of land use, RDM standards could be developed including oak leaves and summer annuals.

Table 1. Minimum RDM standards for dry annual grassland in pounds per acre (dry weight)

Woody cover (%)	RDM standard for percent slope (lb/acre)			
	0–10	10–20	20–40	>40
0–25	300	400	500	600
25–50	300	400	500	600
50–75	NA	NA	NA	NA
75–100	NA	NA	NA	NA

Note: Metric conversion: 1 lb/acre = 1.12 kg/ha.

Table 2. Minimum RDM standards for annual grassland/hardwood rangeland in pounds per acre (dry weight)

Woody cover (%)	RDM standard for percent slope (lb/acre)			
	0–10	10–20	20–40	>40
0–25	500	600	700	800
25–50	400	500	600	700
50–75	200	300	400	500
75–100	100	200	250	300

Note: Metric conversion: 1 lb/acre = 1.12 kg/ha.

Table 3. Minimum RDM standards for coastal prairie in pounds per acre (dry weight)

Woody cover (%)	RDM standard for percent slope (lb/acre)			
	0–10	10–20	20–40	>40
0–25	1,200	1,500	1,800	2,100
25–50	800	1,000	1,200	1,400
50–75	400	500	600	700
75–100	200	250	300	350

Note: Metric conversion: 1 lb/acre = 1.12 kg/ha.

ESTIMATING RESIDUAL DRY MATTER

A variety of means are available for estimating RDM. An easy and quick method is to visually compare photo standards (figs. 1–3) with conditions on the landscape prior to the first fall rains that result in germination, which normally occur around mid- October. Reference photos of grazing intensity standards have been developed for the Central Valley foothills using photos from the San Joaquin Experimental Range (SJER). A moderate level of grazing has been recommended for best livestock performance and rangeland protection for this region of California. Moderate grazing also provides more RDM than listed in the minimum guidelines described in tables 1 and 2. Other grazing intensities, described as light and heavy, are examples of too much or too little use.

RDM levels corresponding to the photographed examples were collected for several years at SJER.

A primary means for measuring RDM is by clipping plots. The guidelines in this publication were developed based on research that involved clipping all standing dry matter in the early fall as close to ground level as possible without undue disturbance to the soil surface. Experience with clipping to the 0.5 inch (12 mm) standard, as commonly applied in areas populated primarily with annual grasslands, leaves behind approximately 25 percent of the total vegetation weight, leading to an inaccurate assessment.

A combination of clipping and visually estimating RDM is commonly used to reduce sampling costs. This may take the form of a structured process, such as the comparative yield method (Haydock and Shaw 1975), or it may be a less structured process whereby an evaluator first clips plots and gradually learns to estimate the RDM by eye. These estimates are commonly recorded on maps and are used to develop visual depictions of RDM across a pasture or landscape (Frost et al. 1988).

Measurement is conducted in the fall prior to the first significant rain. While the timing of fall germinating rain is a moving target, the amount of RDM at that time is the critical factor that ensures soil protection and a favorable microenvironment for the coming year's herbaceous plant community. If RDM is measured earlier, an adjustment must be made to correct for losses from natural breakdown that occurs due to insects, environmental factors, and so on. Without grazing during the dry summer and fall, research has demonstrated that RDM will average a decrease in weight of 7 percent per 30-day period from the time of peak standing crop of annual herbaceous species to occurrence of the germinating rain in the fall (Frost et al. 2005). This rate can be used to calculate backward from the desired RDM amount in October-November to an amount that must be present earlier in the summer. In this study, RDM disappearance at individual locations ranged from a high of 13 percent per 30-day period to a low of no disappearance over the dry summer period in any 1 year. In situations where conservative use and a higher RDM standard is appropriate or

desired, rangeland managers could use the higher observed rate of RDM disappearance, 13 percent per 30-day period, to determine the amount to left at an earlier date.

CLIPPING A PLOT

The technique for clipping a plot for RDM measurement varies between agencies and individuals. The following procedure, recommended by the University of California, is the method that was used in the research on which the guidelines are based.

1. Place the quadrat (usually 1 square foot, or about 1,000 square centimeters) on the ground surface.
2. Remove from the area within the quadrat all summer annuals such as tarweed, yellow starthistle, and turkey mullein.
3. Remove tree leaves.
4. Clip the remaining plant material within the quadrat as close to the ground surface as you can without disturbing the soil.
5. Rapidly collect as much of the clipped plant material as is practical without inadvertently including bits of soil.

Figure 1. Light grazing results in high RDM levels.



Figure 2. Moderate grazing results in the recommended moderate level of RDM.



Figure 3. Heavy grazing results in low RDM levels.



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Guidelines for Residual Dry Matter on Coastal and Foothill Rangelands in California

Grazing Record – Worksheet

Instructions and definitions

1. *Graze Field ID* - Number and/or name of the field being grazed
2. *Period of Grazing* - Beginning and end date the herd was in the particular field
3. *Stocking Rate* - Number of livestock
4. *Livestock / Animal Class* - Use Table 1 below to categorize animal class
5. *Note supplements or hay* -
Dates of feeding, how much per head, for what duration (anything you feel is important)
6. *Wildlife Inventory* - Estimation of how many deer, elk, or other grazing wildlife present on the property during the average month



Table 1

Example of Table filled out:

Operational Kind/ Class Animal
Dry Cow
Cow with calf
Bull, mature
Cattle, 1 yr old
Cattle, 2 yr old
Horse, mature
Sheep, mature

Animal class categories used in prescribed grazing

Graze Field ID	Period of Grazing		Stocking Rate	Livestock
Field 1				Cow/calf
"	"	"		Bull, mature

<p>The general estimation of number of deer, elk, or other grazing wildlife seen on your property on the average month.</p>				Deer:	Elk: Other:

