TOLAY LAKE REGIONAL PARK
RANGELAND RESOURCES STUDY

Submitted to:

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LSA Project No. SOG0601 Task 8

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March 13, 2009

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1.0 INTRODUCTION

This report presents the results of a study of the rangeland resources of Tolay Lake Regional Park (Park). It describes the vegetation and other sensitive resources of the Park. This study was prepared in conjunction with the Biological Resources Study (LSA 2008), and both documents address erosion and non-native species control and recommend restoration of sensitive habitats such as wetlands, native grasslands, and riparian areas. This rangeland resources report specifically addresses those land management activities related to grazing and range management, particularly control of noxious non-native weeds, and both reports should be considered for purposes of habitat enhancement.

Sonoma County Regional Parks (Regional Parks) has acquired and is in the process of improving the 1,737-acre Park southeast of Petaluma, Sonoma County, California to allow for public access (Figure 1). The information and conclusions of this study are designed to be used in support of the Park's Conceptual Master Plan, the related environmental documents, required permit applications, the Park Management Plan, and interpretive information.

1.1 PARK LOCATION AND PROPOSED DEVELOPMENT

The Park property includes rangeland used for cattle grazing, unpaved roads, reservoirs, residences, and agricultural structures. The Park falls within Township 4 north, Ranges 6 and 7 West, on the *Petaluma River, California* and the *Sears Point, California* 7.5-minute series U.S.G.S. quadrangles (Figure 2). The Park is bordered by mostly undeveloped rangeland, vineyards, and private ranches.

The purpose of the project is to provide residents and visitors to southern Sonoma County with recreation opportunities balanced with stewardship of natural and cultural resources. The project consists of improvements to the Cannon Lane access and park entrance driveway, including signage, road widening, driveway realignment, a vehicle turnaround, an entrance gate, and possibly a park kiosk; construction of parking areas, trails, restrooms, equestrian facilities, and picnic facilities; reuse of existing structures for park operations and park employee housing at the Cardoza Ranch complex; restoration of Tolay Lake to its approximate historical condition and an associated water rights application; and construction of boardwalks and viewing platforms along the lake and its margins.

1.2 PURPOSE OF THE RANGELAND RESOURCES STUDY

The purpose of this study is to provide direction for determining rangeland resource goals, strategies to attain those goals, and a monitoring plan to measure their attainment (Bush 2006). It is important to recognize that the effects of livestock grazing on California grassland are highly variable and often masked by extreme yearly fluctuations in rainfall (Huntsinger et al. 2007). Furthermore, grazing responses are dependent upon complex interactions between topography, elevation, soils, species pool, and land use history (Heady 1988). Accordingly, no single grazing regime (including non-use) is optimal for all native species.

This study therefore takes the approach of varying timing and intensity of grazing on a landscape scale to enhance overall species and structural diversity (Huntsinger et al. 2007). This plan is not intended to be rigidly interpreted, it must allow for flexibility to make adjustments over time as results indicate, and to allow for input from grazing lessees to ensure that livestock operations remain economically viable. The approach is based on adaptive management, where monitoring results are used to modify goals and strategies as objectives are met and more information becomes available.

This study is based on the professional judgment of a Certified Rangeland Manager, licensed by the State Board of Forestry (Board). The Board (Policy Number 12) recognizes that boundaries between forests and rangelands and associated professional practices often overlap and that regardless of vegetation cover type the expertise of a Certified Rangeland Manager is desirable and recommended for all rangeland activities.

This study also addresses non-grazing approaches to rangeland management. In a number of management areas, grazing is either precluded because it is incompatible with other management objectives or because non-grazing approaches are more effective in achieving management objectives.

1.3 METHODS

Field Investigations. LSA conducted a review of pertinent literature and conducted interviews with the former ranch owner regarding past livestock operations, recent actual livestock use, and range improvement conditions and needs. Site visits were conducted on March 23, August 8, October 10, and October 30, 2006 to observe rangeland forage composition and productivity, grazing utilization and distribution, and the condition and location of range improvements. See Appendix A for definitions of rangeland management terms. A grazing use map was prepared (Figure 3) by visually using photo standards in the field to estimate residual dry matter (RDM) levels for the entire ranch and mapping areas of light, moderate, and heavy grazing. See Section 5.1.1 for more details on the RDM technique, which is used to measure production.

Range Analysis. A range analysis was conducted to determine preliminary livestock carrying capacity levels (see Appendix A for definitions). Rangeland forage production estimates (pounds of dry matter per acre) were obtained from the appropriate soil survey (Miller 1972), based on the soil types and extent on the Park (Figure 3). An Excel spreadsheet was then used to calculate carrying capacity based on total forage production for each soil type and accounting for target RDM levels (ranging from 750 to 1250 lbs/ac) and consumption of 780 lbs of dry matter per animal unit month.

Ecological Sites. Ecological sites (formerly called range sites) are areas with similar soils, topography, and vegetation. They are classified for purposes of calculating wildlife and livestock forage production and carrying capacity (see Appendix A for definitions). The Sonoma County Soil Survey (Miller 1972) identifies soil types, aggregates them into ecological sites, and provides estimates for dry-weight forage production for each. These dry-weight production estimates were then used in this study to calculate available forage (Appendices B and C). This study makes the assumption that approximately 780 lbs of dry forage are required to support one cow-calf pair or equivalent for one month, an amount of forage referred to as an animal unit/month (AUM).

The following ecological sites have been identified as present at the Park:

- Because of similar qualities, Clear Lake clay was placed in the **Clayey Hills** ecological site based on the preparer's professional judgment. The fine textured clay and clay loam soils on flats and relatively gentle and uneroded slopes (Clear Lake clay loam 0–2 percent slopes, Diablo clay 2-9 percent slopes, Diablo clay 9–15 percent slopes, Diablo clay 15–30 percent slopes) are highly productive because of high water holding capacity and deep rooting depth. This ecological site produces up to 3600 lbs/ac of dry forage in a favorable (wet) rainfall year, 2700 lbs/ac in an average rainfall year, and 1800 lbs/ac in an unfavorable (dry) rainfall year (see tables in Appendix B).
- Productivity is less on steep and/or eroded slopes of the **Steep Clayey** ecological site consisting of Diablo clay 15–30 percent slopes, eroded and Diablo clay 15–30 percent slopes, eroded. This ecological site produces 3300 lbs/ac of dry forage in a favorable year, 1800 lbs/ac in an average year, and 800 lbs/ac in an unfavorable year.
- The **Shallow Loamy Uplands** ecological site consisting of Goulding clay loam, Laniger loam 9–15 percent slopes, and Laniger loam 9–15 percent slopes, produces 2400 lbs/ac of dry forage in a favorable year, 1800 lbs/ac in an average year, and 1200 lbs/ac in an unfavorable year.
- The **Claypan** ecological site (Haire clay loam) produces 2800 lbs/ac of dry forage in a favorable year, 2200 lbs/ac in an average year, and 1600 lbs/ac in an unfavorable year.
- The **Shallow Rocky** ecological site (Toomes rocky loam) produces 1800 lbs/ac of dry forage in a favorable year, 1300 lbs/ac in an average year, and 800 lbs/ac in an unfavorable year.
- Because the **Toomes and Goulding** soils are mapped as a complex and not separately, this analysis assumes an intermediate productivity for that mapping unit as if composed of each ecological site equally.

Stocking Rate Calculations. A grazing impact analysis was conducted using a model (2005 Wildland Solutions), which determines the optimum grazing regime for achieving each objective. The regime includes season of use and stocking rates (including non-use), which is directly correlated with grazing use levels. A light stocking rate removes about 25 percent of the forage each year, leaving the equivalent of 1250 lbs/ac of RDM. Conservative stocking removes no more than 50 percent of the forage, leaving about 1000 lbs/ac , moderate stocking removes 50 to 75 percent of the forage (750 lbs/ac RDM), and heavy stocking removes more than 75 percent the forage (leaving less than 500 lbs/ac or less). This analysis helps provide specifics on how resource objectives can be achieved through grazing, and describes the grazing regimes best suited to achieving those objectives.

2.0 EXISTING CONDITIONS

Existing conditions are summarized here to provide a framework for formulation of management goals and approaches for preserving and enhancing rangeland resources at the Park.

2.1 PHYSICAL FACTORS

2.1.1 Topography

The Park is situated in the Coast Ranges geomorphic province, an approximately 600-mile stretch of mountain ranges and valleys that extends from the Oregon border south to the Santa Ynez River in Santa Barbara County, California. The Coast Ranges are divided into north and south subprovinces, with San Francisco Bay marking the division between the two. The Park, consisting of 1,737 ac, is in southern Sonoma County within a northwest-southeast oriented valley with gentle-to-steep sloping hills. The valley is drained by Tolay Creek, which flows southerly into San Pablo Bay (the northern arm of San Francisco Bay). To the west of the Park is the Petaluma River Basin, to the east and north rolling hills and low mountains, and to the south is the southern end of Tolay Valley which opens to the tidal marshes of northern San Pablo Bay.

2.1.2 Soils

The Park encompasses several soil map units as described in the USDA Soil Survey of Sonoma County, California (Miller 1972). The Tolay Lake bed and lower terraces area are mapped as Clear Lake clay loam, 0 to 2 percent slopes (Figure 3). The area mapped as Clear Lake clay loam roughly corresponds to the extent of former lake inundation before it was drained in the mid-nineteenth century. Clear Lake soils are formed in poorly drained alluvial sediments, have slow permeability, high water holding capacity and a deep rooting zone.

Much of the foothill land northeast of Tolay Lake and Tolay Creek is mapped as Diablo clay, 2 to 9 percent slopes, and Diablo clay, 9 to 15 percent slopes. The hill slopes southwest of Tolay Lake and Tolay Creek are mapped as Diablo clay, 9 to 15 percent slopes. Most of the adjacent West Ridge is mapped as Diablo clay, 2 to 9 percent slopes, and the southwest facing slopes beyond are mostly mapped as Diablo clay, 9 to 15 percent slopes; Diablo clay, 15 to 30 percent slopes; and Diablo clay, 30 to 50 percent slopes, eroded. Diablo clays are formed on sandstone, siltstone, and shale bedrock and are well drained with rooting depths of 40 to 60 inches.

The lower elevation hill slopes to the northeast are mapped as Goulding–Toomes complex, 9 to 50 percent slopes, and the upper slopes and ridge are mapped mostly as Laniger loam, 15 to 30 percent slopes, eroded. The Goulding-Toomes complex soil is formed on volcanic rocks and is well drained. The Laniger soils are formed on rhyolite and are well drained. An area north of the lake is mapped as Haire clay loam, 9 to 15 percent slopes. The Haire clay loam formed on mixed alluvium and is moderately drained.

2.1.3 Hydrology

The Park receives an average annual rainfall of approximately 28 inches, most of it falling between November and March. Tolay Creek flows southeastward through the central portion of the site. The upstream portion of Tolay Creek on the project site is a large, shallow basin, named Tolay Lake, which ponds water seasonally. The lake has been ditched and drained for farming within its bed. The Tolay Creek channel downstream of Tolay Lake has been partially channelized and deepened to facilitate draining the lake. Hill slopes southwest of Tolay Creek rise to West Ridge, which parallels Tolay Creek. The northeast face of this ridge is drained toward Tolay Creek by multiple small, roughly parallel channels and swales, some of which contain seeps. The southwest facing slope of West Ridge drains toward the Petaluma River in a complex channel pattern. Portions of this slope contain slumps and seeps.

Much of the land immediately northeast of Tolay Lake and Tolay Creek is relatively flat or gently sloped and is drained toward Tolay Creek in constructed agricultural ditches. Most of these ditches contain perennial wetland vegetation and appear to contain water much of the year. This area contains seasonally wet or ponded features.

The hill slopes and ridge in the northeast portion of the site, known as East Ridge, contain multiple drainage swales and channels, which all drain to Tolay Creek. These hill slopes contain seeps and channels with wetland characteristics. Soil slumping has created hummocky topography and large gullies. Two large reservoirs, named Pond 1 and Pond 2, were constructed to capture runoff and flow from multiple nearby springs and seeps for stockwater and irrigation purposes. These reservoirs drain to Cardoza Creek, which joins Tolay Creek near the southeast project site boundary.

2.2 BIOLOGICAL RESOURCES

The biological resources of the Park are documented in the Biological Resources Study (LSA 2008). This brief summary focuses on resources most relevant to livestock grazing and conservation goals. Figure 4 illustrates locations of the major weed infestations and eroded areas on the Park. Figure 5 illustrates locations of sensitive biological resources on the Park such as wetlands, special-status plant species, and sensitive vegetation types.

2.2.1 Non-Native Weeds

Non-Native Grasslands. Non-native perennial grasslands throughout California were converted to non-native annual grasslands during the early settlement period of the late 1700s and early 1800s. This vegetation type conversion resulted from introduction and spread of vigorous Mediterranean annual grasses by European settlers and livestock, which replaced the native perennial grasses already weakened by prolonged overgrazing, other human disturbances, and extended drought (Heady 1988). The introduced annual grasses have several adaptations to compete successfully against the native perennials, including the capability to produce seed under adverse grazing pressures and weather regimes (Menke 1992).

Accordingly, the most common plant community of the Park is non-native grassland dominated by Italian ryegrass (*Lolium multiflorum*) and medusahead (*Taeniatherum caput-medusae*). Medusahead is an unpalatable and invasive grass that dominates large areas on the West Ridge. Other non-native

grass species include wild oats (*Avena fatua, Avena barbata*), hare barley (*Hordeum murinum* ssp. *leporinum*), ripgut brome (*Bromus diandrus*), and soft chess (*Bromus hordeaceous*).

Annual grasses (except medusahead) provide high quality and nutritious livestock forage when they are green during the rainy season, generally after late fall or winter (October-December). The grasses "cure" (dry) in the late spring or early summer (April-May), after which nutrition levels drop rapidly.

Non-native grasslands include many weedy species including broad-leaf filaree (*Erodium botrys*), red-stemmed filaree (*Erodium cicutarium*), common vetch (*Vicia sativa* ssp. *nigra*), geranium (*Geranium molle*), shepherd's needle (*Scandix pecten-veneris*), rose clover (*Trifolium hirtum*), subterranean clover (*Trifolium subterraneum*), and milk thistle (*Silybum marianum*). Non-native grasslands on the site also support numerous native wildflowers including Ithuriel's spears (*Triteleia laxa*), white brodiaea (*Triteleia hyacinthina*), Fremont's star lily (*Zigadenous fremontii*), blue-eyed grass (*Sisyrinchum bellum*), California poppy (*Eschscholzia californica*), cream cups (*Platystemon californicus*), sun cups (*Camissonia ovata*), soap plant (*Chlorogalum pomeridianum*), California checker mallow (*Sidalcea malvaeflora*), Johnny jump-up (*Viola pedunculata*), morning-glory (*Calystegia subacaulis*), false lupine (*Thermopsis macrophylla*), mule ears (*Wyethia angustifolia*), and yampah (*Perideridia* sp.).

Other Non-native Upland Weeds. In addition to medusahead, Italian thistle *(Carduus pycnocephalus),* bristly ox-tongue (*Picris echioides*), yellow star-thistle *(Centaurea solstitialis),* and purple star-thistle (*Centaurea calcitrapa*) are the most common non-native invasive plants on the upland portions of the Park. Large stands of these weeds occur throughout the project site, especially in the central part (Figure 4). Bristly ox-tongue covers large areas in the central part of the project site, especially in the cultivated areas east of Tolay Lake. From these formerly cultivated areas, bristly ox-tongue has colonized the adjacent grasslands. Milk thistle, another invasive species, is less common at the Park. Other non-native weed species that are less invasive and grow relatively sparsely on the Park include bull thistle (*Cirsium vulgare*), jointed charlock (*Raphanus raphanistrum*), and dandelion (*Taraxacum officinale*).

Water Smartweed. Both Tolay Lake and portions of Tolay Creek are currently closed to grazing and support dense monocultures of water smartweed (*Polygonum amphibium* ssp. *emersum*) sp.), an invasive weed. The Tolay Lake bottom is bare of vegetation while ponded and was dominated by cultivated vegetation when it was farmed. Under present fallow conditions it supports a variety of plant species as it dries. In the summer weedy species emerge in the dry bottom of the lake.

A dense monoculture of water smartweed is established in Tolay Lake south of the causeway. North of the causeway, water smartweed grows mixed with other wetland plants. Water smartweed and small stands of native cattails (*Typha* sp.) and tules (*Scirpus* sp.) form a complete cover over the creek between Tolay Lake and the Farm Bridge, which is 700 feet downstream of the lake. Non-native poison hemlock (*Conium maculatum*) grows on the upper edge of the banks. Downstream of the bridge, where cattle graze in the channel of Tolay Creek, is a more diverse and open vegetation, including cattails and tules.

Water Primrose. Water primrose (*Ludwigia* sp.) is a perennial species, which has been found in the Park only in the Duck Pond (Figure 3). This highly aggressive species covers all but a small area in the center of the pond by summer. Water primrose is an emergent species with much of its biomass

growing above the surface of the water. This invasive species has a high potential to spread beyond the Duck Pond and cause inestimable environmental damage, especially in Tolay Creek.

2.2.2 Native Grasslands

Native grasslands are considered sensitive biological resources because little of the original native California grassland remains in low elevation areas of California, including the Park. Communities dominated by native grasses and graminoids that occur in the Park include moist grasslands and needlegrass grasslands (Figure 5). The wettest grasslands support California semaphore grass (*Pleuropogon californicus*), sedges (*Carex* spp.), and rushes. Other moist grasslands support native grass species that require relatively high summer moisture levels such as creeping wildrye (*Leymus triticoides*), meadow barley (*Hordeum brachyantherum*), and California oatgrass (*Danthonia californica*). Needlegrass grasslands, occurs in small stands on drier slopes throughout the Park, but more commonly in the southeastern portion (Figure 5). This community is dominated by purple needlegrass (*Nassella pulchra*), often in association with California oat grass.

2.2.3 Oak Woodland

Oak woodland occurs in a relatively large stand on the top of the ridge in the east part of the Park and in smaller stands in the draws (gullies) on the ridge (Figure 5). This community is dominated by coast live oak (*Quercus agrifolia*) and California bay (*Umbellularia californica*) with scattered madrone (*Arbutus menziesii*) and black oak (*Quercus kellogii*). The coast live oak trees on the East Ridge are very large with many trunk diameters averaging or exceeding 4 feet diameter at breast height (4.5 feet from the ground). There is little evidence of regeneration in the form of oak seedlings or saplings. Factors limiting coast live oak regeneration are many, complex, and interactive. Most notable among these are rainfall, competition with non-native grasses, and herbivory by small mammals (Tyler et al. 2002). Livestock browsing damage to green seedlings and saplings may be a factor in oak mortality, especially in the dry season (Wildland Solutions 2005).

Understory of oak woodland is predominantly non-native grassland with few woody plants. Herbaceous species in the understory include miner's lettuce (*Montia fontana*), bedstraw (*Galium aparine*), Pacific sanicle (*Sanicula crassicaulis*), and nemophila (*Nemophila heterophylla*). Western lady-fern (*Athyrium filix-femina*) grows in the oak woodland on the shady slope of the north exposure. Oak woodlands are considered to be biologically important plant communities because of high wildlife values, providing food, cover, and nesting habitat.

2.2.4 Riparian Woodland

Tolay Creek and Cardoza Creek support the most developed stands of riparian woodland at the Park with the largest stands at the southern portion of the park along Tolay Creek (Figure 5). Other watercourses support single willows (*Salix* sp.) or small stands composed of a few trees.

Riparian woodland is dominated by various combinations of arroyo willow (*Salix lasiolepis*), red willow (*Salix laevigata*), yellow willow (*Salix lucida* ssp. *lasiandra*), and sandbar willow (*Salix exigua*), with scattered cottonwood (*Populus fremontii* ssp. *fremontii*), coast live oak, California bay, California buckeye and non-native wild plums (*Prunus* sp).

Native shrubs are largely absent from the riparian woodland apparently due to historical heavy year-round browsing by cattle. Himalayan blackberry (*Rubus discolor*) is an invasive non-native shrubby vine, which is resistant to cattle browsing and occurs in some riparian areas.

2.2.5 Wetlands

Wetlands on the study site are composed of seeps, springs, and seasonal wetlands. Seasonal and perennial wetland seeps and springs occur on many of the slopes within the Park. The hydrology of these seeps and springs appears to be the result of groundwater flowing from cracks in the underlying bedrock. Some of these seeps and springs are extensive, especially those that occur near Pond 2 (Figure 5). Permanent springs produce flowing surface water and support wetland vegetation including soft rush (*Juncus effusus*), iris-leaf rush, common monkey-flower, water cress (*Rorippa nasturtium-aquaticum*), spiny-fruit buttercup (*Ranunculus muricatus*), straight-beaked buttercup (*Ranunculus orthorhynchus* var. *bloomeri*), brown-headed rush (*Juncus phaeocephalus*), common monkey-flower (*Mimulus guttatus*), and pennyroyal (*Mentha pulegium*).

Certain seeps have created conditions resulting in rotational land slumps. Soil water, along with some surface runoff, collects in seasonal ponds above these rotational land slumps. These seasonal ponds are dominated by rabbit's-foot grass, brown-headed rush, creeping spike rush (*Eleocharis macrostachya*), smooth rush, white water buttercup (*Ranunculus aquatilis*), Lobb's aquatic buttercup (*Ranunculus lobbii*), and flowering quillwort (*Lilaea scilloides*). Annual miner's lettuce and spiny-fruit buttercup also occur in these seasonal ponds in the spring.

Seasonal wetlands occur on the flat top of the West Ridge and on shallow slopes and swales of the East Ridge (Figure 5). Hydrology of these features is provided by direct rainfall and run-off. The seasonal wetlands of the West Ridge occur on level, impermeable soils or a shallow soil over impermeable bedrock. Small seasonally wet areas above these impermeable substrates are dominated by armed coyote thistle (*Eryngium armatum*).

Two small and shallow seasonal wetlands occur on the crest of the ridge near the southwestern boundary of the park (Figure 5). Because they are shallow, they would be expected to dry sometime between March and May on any given year. Plant species include Mediterranean barley, armed coyote thistle, Lobb's aquatic buttercup, and water-starwort *(Callitriche heterophylla)*.

2.2.6 Special-Status Plants

Two special-status plant species described below have been observed at the Park.

Fragrant Fritillary. Fragrant fritillary *(Fritillaria liliacea)*, a California Native Plant Society (CNPS) list 1B species, occurs in two locations on the east-facing portion of the ridge that runs along the western axis of the Park. Approximately fifteen plants grew with Fremont's star lily (*Zygadenous fremontii*) at a northern location (designated by two dots on Figure 5) and a single plant grew with non-native annual grasses at a southern location (designated by one dot on Figure 5). Fragrant fritillary grows from a bulb and, along with Fremont's star lily, is one of the first wildflowers to bloom in the spring (February-March).

Lobb's Aquatic Buttercup. Lobb's aquatic buttercups, a CNPS list 4 species, grows in shallow pools in the spring. Their white flowers and leaves float on the surface of the water. It was found in a seasonal pool at the base of a slump and a vernal pool on the top of the ridge along the western axis of the Park (Figure 5). This plant is an annual.

2.2.7 Special-Status Animals

An un-named subspecies of the zerene silverspot (*Speyeria zerene*) occurs on the Baylands Property just south of the Park. This butterfly could occur at the Park because it is adjacent to a known population and supports populations of the butterfly larval food plant. The larvae of the zerene silverspot feed upon violets such as Johnny jump-up which commonly grows on both the east and west ridges of the Park (Figure 5). This un-named subspecies of silverspot butterfly is likely to be very uncommon, and is a resource that should be protected. For that reason, management activities that are beneficial to the food plant Johnny-jump-up should be considered.

The larvae of Opler's longhorn moth (*Adela oplerella*), another special-status insect, feed on cream cups. This native wildflower is found at the Park (Figure 5). Although the moth has not been identified on the Park property, it is potentially present. For that reason, management activities that are beneficial to the food plant should be considered.

2.3 LAND USE

2.3.1 Historical Grazing and Agricultural Use

The ranching era in Sonoma County began with a grant of 44,000 acres from the Mexican government to Mariano G. Vallejo to form Rancho Petaluma, which included the Tolay Lake property. This grant was confirmed in 1843, when an additional 22,000 acres was added to Rancho Petaluma. As part of Rancho Petaluma, the Tolay Lake margins and foothills would have served as rangeland for the large herds of cattle, horses, and sheep owned by Vallejo. Cattle ranching in coastal California during this period was based on the sale of hides and tallow. Meat was only used on a subsistence level and much was wasted due to low demand and absence of refrigeration. Cattle were allowed to roam freely over the unfenced range, and were only concentrated twice per year; during the spring rodeo when calves were branded and castrated and the late summer matanza when older cattle (four years minimum) were slaughtered. Records show that Rancho Petaluma supported 15,000 cattle in 1841 (Stilliman 2004). This number probably underestimates the grazing pressure during this period as large herds of wild cattle and horses competed for forage with domesticated livestock. The rapid increases of domestic and feral livestock herds during the Rancho period resulted in localized overstocking, with ranchers often complaining about lack of feed.

Once one of the wealthiest men in the state, Vallejo lost most of his land and livestock due to legal challenges in the aftermath of the Gold Rush and California Statehood. Squatters forced him to sell his Rancho (including the Tolay Lake holdings) in 1857. The Tolay Lake Ranch was operated between 1857 and 1943 by a succession of owners who raised livestock (sheep, dairy cattle, beef cattle, and horses) and grew hay, wheat, and grapes on the property. The fact that the lakebed and lower terraces of the Tolay Lake ranch were historically tilled and cropped is important to the understanding of current biotic conditions, especially the scarcity of native vegetation and high weed cover in those areas.

Although details are lacking, historical livestock grazing operations during this period on the Tolay Lake ranch likely mimicked trends throughout the San Francisco Bay Region. Because of a pronounced increase in the demand for beef after the Gold Rush, livestock production boomed throughout the region. Soon after livestock numbers peaked in 1860, two successive years of extreme drought (1862-1863) resulted in severe overgrazing and eventual starvation of millions of livestock. It was during this period that most of the degradation of California rangelands occurred (Burcham 1957). The drought devastated the livestock industry and taught ranchers that they could not rely solely on range feed, and they began to raise grain, alfalfa and other supplemental forage. Beef cattle numbers increased again beginning in the 1880s and continuing into the 20th century on northern California's rangelands. As a result, overstocking and further degradation of rangelands continued. Overstocking was probably not deliberate but resulted from the fact that most ranchers were from the midwest and east and lacked knowledge of California's vegetation and climate (especially summer drought).

2.3.2 Recent Grazing and Agricultural Use

Cardoza Family Ranch. The Tolay Lake property was purchased by the Cardoza family in 1943 and remained in their family until they sold it to Sonoma County in 2005. The family grew crops, hay and grain, and raised dairy cattle, sheep, and beef cattle. By 2005, livestock production was limited to an Angus and Hereford beef cow-calf operation. The ranch supported about 150 cow-calf pairs when the lakebed and lower terrace fields were farmed and not grazed, and from 200 to 250 cow-calf pairs after farming on the lower terrace fields ceased and they were available to grazing (Cardoza pers. com. 2006). This equates to about 8 acres per animal-unit (one cow-calf pair) per year or 0.7 animal unit months (AUM) per acre. After the ranch was sold to the Regional Parks, the Cardoza family removed the cattle earlier than usual. Cattle were removed from the ranch by mid-summer in 2006. As a result much of the area was not grazed or lightly grazed; moderate grazing levels were limited to a few "loafing" areas on windy hilltops (for refuge from heat and flies); heavy grazing levels were surrounded by moderate grazing at one salting location, a seep and water trough in the Eastern Hills, and a portion of lower Tolay Creek (Figure 3).

In recent times, livestock grazing has become a marginal economic enterprise in the San Francisco Bay region due to elevated land prices and land use pressures. In addition, low beef prices and highly variable forage production due to rainfall extremes combine to make cattle ranching a borderline industry (Bush 2006). For example, to sustain their business the Cardoza family raised grain crops, vegetables, grapes, and fruit, and charged the public for a popular annual pumpkin festival. The economic marginality of rangeland livestock operations is important for park planning purposes to ensure that livestock grazing remains economically viable, especially given the Sonoma Regional Park mission of maintaining biological diversity and agricultural land uses.

Current Lessee. Since the Cardoza family sold their ranch and the Regional Parks has assumed management of the Park, the Cardoza's cattle have been removed from the property. For the last year, Glen Mohring of H & L Mohring Ranch is in Pinole has used the Park for cattle grazing. Last year Mr. Mohring (2007) grazed approximately 200 animal units (cow-calf pairs) at the Park under a license with the Regional Parks. That license allows for up to 225 animal units to be grazed on the Park.

2.3.3 Livestock Infrastructure

As discussed above, the Tolay Lake property, formerly the Cardoza Ranch, has a long history of livestock use resulting in development of fences, water sources, and other infrastructure. It is currently leased from the Regional Parks for cattle grazing by an adjacent private rancher who is responsible for maintaining these facilities. The perimeter of the Park is surrounded by a fence consisting of welded wire topped by three strands of barbed wire (designed for sheep grazing but also effective in containing cattle). A swinging tubular steel vehicular gate provides access for vehicles from Cannon Road. Several informal barbed wire gates provide for ingress and egress of livestock from adjacent private ranches (Figure 6).

A series of interior barbed wire fences divides the Park into seven pastures (Figure 6). These do not include Tolay Lake and adjacent terraces that are to be excluded from livestock grazing under a grant agreement with the State Wildlife Conservation Board (WCB). Pasture 1 (Northwest Hills) includes Cannon Road, barns, residences, and a separately fenced 4-acre bullpen. The western hills are divided into Pasture 2 (Central West Hills) and Pasture 3 (Southwest Hills). Pasture 4, designated as the Tolay Creek Pasture, includes Pond 2 and the portion of Tolay Creek downstream from the Tolay Lake exclusion (Figure 3). Two pastures occur on a gently sloping terrace along the east shore of Tolay Lake; a North Terrace Pasture and a South Terrace Pasture. The Eastern Hills Pasture is enclosed by the perimeter fence and the interior fences along the two Terrace Pastures. The interior fence between pastures 2 and 3 includes a swinging tubular vehicular gate to provide access along the PG&E power lines. Several informal barbed wire gates have been installed over the years between pastures to allow vehicular and pedestrian access and ingress/egress of livestock between pastures (Figure 6).

Permanent year-long drinking water for livestock is provided by two impoundments on Cardoza Creek (Ponds 1 and 2), the Duck Pond, and the Willow Pond. In addition, water troughs have been installed that are fed by groundwater piped from developed spring boxes (Figure 6).

2.3.4 Non-Grazing Areas

Tolay Lake Special Management Zone. This area (Figure 6) has been excluded from grazing under the terms of a grant from the State Wildlife Conservation Board in order to protect the conservation values of the property. The Conservation Values are defined as wildlife and habitat values (Article B in Conservation Easement Deed). However, grazing is permissible by this conservation easement if it is part of a California Department of Fish and Game management plan. The Federated Indians of Graton Rancheria (FIGR) have expressed concerns about grazing impacts on cultural resources in this area. Accordingly, per the recommendations in the Tolay Lake Regional Park Cultural Resources Plan (LSA 2007), the Regional Parks will coordinate with FIGR prior to initiating conservation grazing activities in the Tolay Lake Special Management Zone. T

Tolay Lake is a seasonal waterbody, which dries out in the summer. Historically the lakebed has been intensively cultivated and planted in agricultural row crops. Since the Regional Parks has acquired the property, the lakebed has been fallow. Dense and extensive stands of noxious weeds have subsequently become established in the highly perturbed soils. Even in the wet season, the infestation of weeds in some places is so extensive as to drastically limit the value of the lake to visiting waterfowl and other wildlife (LSA 2008).

Vineyard. A vineyard has been excluded from grazing during the Cardoza period of ownership of the property (Figure 6). The Regional Parks has continued this land use under contract.

STRAW Exclosures. The non-governmental organization Bay Institute sponsored the Students and Teachers Restoring a Watershed (STRAW) Project. STRAW has installed grazing exclosure fences to protect revegetation projects. A STRAW exclosure is located on the ridge in the Southwest Hills Pasture, and another exclosure is located above Tolay Creek in the Tolay Creek Pasture (Figure 6).

2.4 CULTURAL RESOURCES

The Park contains significant historical and prehistoric cultural resources (LSA 2007). Because of the confidential nature of these resources, locations of sites are not included in this public-disclosure report. However, the recommendations of the rangeland study considers these resources.

3.0 LIVESTOCK GRAZING IMPACTS AND MITIGATION

3.1 BACKGROUND

Grazing ungulates, including wildlife, can cause several interrelated beneficial and adverse impacts on native vegetation, water quality, and other resources. The adverse impacts of livestock grazing are well documented. Grazing animals defoliate plants, change nutrient dynamics, and cause mechanical trampling damage. Removal of plant tissue by grazing reduces photosynthetic and reproductive capacity and affects roots to various degrees depending on the plant species and growth habitat. Grazing animals are also highly selective. Rangeland plant species composition is affected by upon the frequency, intensity, and seasonality of grazing (Bush 2006). In addition, trampling damage from livestock concentrations can damage vegetation and cultural resources, compact soils, and increase erosion and sedimentation. Runoff from livestock manure can decrease water quality by increasing levels of turbidity and sedimentation, nutrients, and coliform bacteria (SWRCB 1995).

The beneficial impacts of livestock grazing on biological diversity have also been recognized. Many ecologists and rangeland managers suggest that livestock-grazing, if *properly managed*, can play an important role in the conservation and restoration of California's grasslands and associated seasonal wetlands (Barry 1996, Robins and Vollmar 2002, Marty 2005). Livestock grazing has shaped the hydrology and ecology of coastal and valley grasslands in California. For example, cessation of grazing favors non-native annual species around the margin of seasonal wetlands and may alter their hydrology by increasing RDM, thereby reducing runoff and infiltration (Robins and Vollmar 2002, Marty 2005). A study in South Sacramento County showed that removal of cattle grazing from seasonal wetlands significantly reduced ponding duration and native plant and animal abundance (Marty 2005, Pyke and Marty 2005). Plant diversity was not affected by different levels of livestock grazing in and around springs, but diversity increased in small creeks flowing from those springs under moderate grazing levels (Huntsinger et al. 2007).

A recently published guide for resource managers in coastal California (Bush 2006) and other sources cite beneficial impacts of livestock grazing for fire hazard management, forage production, native grassland restoration, weed management, and wildlife management. Livestock exclusion tends to convert grasslands to a dominance of tall annual grasses such as soft chess, ripgut brome, and wild oats (Heady 1988, Huntsinger et al. 2007). Annual ryegrass commonly becomes a problem grass when not grazed, building up particularly thick thatch layers. This grass is also becoming more abundant in grassland habitats subject to excessive nitrogen deposition associated with air pollution plumes near highways and downwind of urban and industrial areas (Fenn et al. 2003, Weiss 1999). These tall, fast growing grasses shade out native grasses and forbs (wildflowers) with thatch. Grazing or other removal of plant material reduces the accumulation of dead residual matter in the dry seasons, and increases nutrient recycling. Opening up the herbaceous canopy increases light penetration and limited disruption of the soil surface by ungulate hoofs allows for good soil-seed contact which in turn increases seed germination and seedling establishment. Appropriately timed grazing or other methods of vegetation removal such as mowing, cutting, or burning can also be used to promote increases in native perennial grass and forb populations and to reduce the proportions of the nonnative annual grasses (Menke 1992).

Livestock exclusion in coastal California, in combination with fire suppression, eventually leads to invasion of the grasslands by coyote brush *(Baccharis pilularis)* and associated shrub species. This has been documented to result in replacement of grassland with coyote brush scrub greatly increasing vegetation fuel loads and associated fire hazards (McBride 1974). Ungrazed grasslands also provide much higher easily ignited fine herbaceous fuel loads ("flash fuels") in the form of dead standing grass and litter ("thatch"). Accumulations of herbaceous fuels in these grasslands are highly flammable during the dry season and can carry a wildfire quickly to buildings and inhabited places and to the woody fuels of scrub and woodlands. Ungrazed grasslands producing 2,000 lbs/ac of dry fuel can have flame lengths exceeding 50 feet, while moderately grazed grasslands with 1,000 lbs/ac have flame lengths of 4 to 10-feet-long, and heavily grazed grasslands (500 lbs/ac) fires typically burn only in isolated patches (Wildland Solutions 2005). The fire hazard reduction benefit alone is enough incentive for many grassland managers to employ grazing on their lands. Grazing by cattle or horses (which prefer grass over forbs) at moderate stocking rates in the early season (November-March) or yearlong is the best strategy for reducing non-native annual grass competition and thatch levels and for resisting brush encroachment.

3.2 BENEFICIAL IMPACTS

Based on the factors discussed above, the following beneficial impacts of livestock grazing on the Park have been identified. These impacts do not require mitigation measures, but flexible management strategies as adapted by monitoring results should be implemented to ensure their efficacy. Goals, strategies, and monitoring techniques and schedules are discussed in the Management Plan section.

Beneficial Impact 1: Preservation of the Agricultural Working Landscape. Sustainable livestock grazing operations preserve the rural atmosphere, enhance historical landscape values, benefit the local economy, and provide a cost-efficient tool for achieving other beneficial impacts.

Beneficial Impact 2: Fire Hazard Reduction. Livestock grazing provides a cost-efficient tool for reducing wildland herbaceous fuel loads and resisting brush encroachment. However, brush reduction needs to be placed in the context of overall Park management goals. The existing habitat needs to have the shrub component dramatically enhanced. Due to years of range overuse, the woody and even herbaceous understory component is largely missing. Restoration of this component has been identified as a key goal for the biological improvement of the Park.

Beneficial Impact 3: Native Grassland Preservation and Enhancement. Although subject to many variables, properly managed moderate levels of livestock grazing are compatible with preservation of native grasslands, and specific grazing regimes may help to enhance native grasslands by suppressing competition with non-native annuals and reducing thatch.

Beneficial Impact 4: Preservation and Enhancement of Native Wildflowers. Although subject to many variables, properly managed and monitored moderate levels of livestock grazing are compatible with preservation of native wildflowers, and specific grazing regimes may help to enhance wildflowers by suppressing competition with non-native annuals and reducing thatch.

Beneficial Impact 5: Preservation and Enhancement of Seasonal Wetlands. Although subject to many variables, properly managed levels of livestock grazing may be compatible with preservation

and possible enhancement of seasonal wetlands, seeps, and intermittent streams. However, under most management regimes where intensive monitoring is not practical, it is often necessary to fence sensitive wetlands resources off from grazing or at least severely limit the intensity and duration of grazing pressure.

Beneficial Impact 6: Control of Invasive Non-Native Plants. The spread of invasive non-native plants can be controlled by proper moderate levels of grazing. Invasive plant populations can also be controlled or diminished in density and cover by carefully prescribed grazing treatments in combination with other control methods (manual, chemical, mechanical, biological) in an Integrated Pest Management (IPM) approach.

Beneficial Impact 7: Preservation and Enhancement of Wildlife Habitat. Livestock grazing can be compatible with maintaining wildlife habitat for many species and may help enhance habitat for wildlife species that prefer shorter grass heights and disturbed habitat.

3.3 ADVERSE IMPACTS AND MITIGATION MEASURES

Based on the factors described in the background discussion and regional guidelines (Bush 2006), the following potential adverse impacts of livestock grazing on the Park have been identified. These impacts are followed by mitigation measures recommended to minimize impacts. Most of these mitigation measures require implementation of flexible management strategies as adapted by monitoring results as discussed in the Rangeland Management Plan (below).

Adverse Impact 1: Undesirable Vegetation Changes. Grazing levels that are too heavy (overgrazing), inappropriate seasons of use, or prolonged duration of grazing can degrade native plant communities. Heavy prolonged grazing, especially in the dry season, can damage or kill native woody plant seedlings. This can result in degradation of desirable native communities such as oak and riparian woodland. Heavy, poorly timed grazing can also exacerbate infestation of invasive plants that thrive in disturbed situations including Italian thistle, purple star-thistle, yellow star-thistle, and medusahead.

> **Mitigation Measure 1: Moderate Managed Grazing.** Grazing should not exceed moderate levels except for short duration grazing to achieve specific management objectives. Prolonged grazing in the dry season should be alternated with rest from year to year in areas where woody native vegetation is being impacted. Livestock distribution should be improved and concentrations around water and supplement sources minimized to avoid heavy disturbance. Other grazing regimes may be prescribed to achieve specific vegetation objectives based on monitoring results and adaptive management.

Adverse Impact 2: Erosion and Water Quality Impacts. Overgrazing, especially during the wet season, may cause streambank erosion and direct deposition into waterways. Heavy livestock concentrations on steep slopes, especially on clay soils during the wet season, can cause upland erosion with indirect sedimentation from runoff.

> **Mitigation Measure 2: Managed Livestock Distribution.** Grazing management should be implemented to improve livestock distribution and minimize trailing up and down slopes. Grazing should be managed carefully in wetlands, waterways, and riparian zones to minimize

livestock concentrations when soils are saturated (although this may conflict somewhat with Mitigation Measure 1 to minimize use of riparian areas during the dry season). Prolonged livestock confinement (such as in barns or corrals) should be avoided to minimize manure concentrations that can be conveyed in runoff to waterways.

Measures to improve livestock distribution recommended in this plan include development of additional water sources, strategic placement of supplemental feeds and minerals, additional fencing, and construction of shade structures. Additional water sources placed at ½ to 1 mile intervals will reduce concentrations around existing water sources. Salt, mineral, and feed supplements should be placed in strategic locations at least 1,000 feet from water sources where practical and relocated periodically as needed to prevent use levels from exceeding the recommend target levels discussed below. Where trailing is causing erosion or trampling damage, temporary drift fences can be installed to redirect livestock movements. Additional fencing to create smaller pastures and rotational grazing to place more livestock on smaller areas for short-term periods will also improve livestock distribution. In areas devoid of trees such as the western hills, installation of shade structures may be considered in consultation with the Sonoma County Natural Resources Conservation Service.

Adverse Impact 3: Negative Impacts to Wildlife. Heavy, improperly timed, and prolonged continuous grazing can adversely impact many wildlife species. Especially vulnerable are birds that nest in the understory or herbaceous ground layer of riparian vegetation. Heavy grazing can also create shifts in small mammal populations, favoring species that prefer short grasses over those preferring tall grasses. Fencing required to facilitate livestock operations could also impact wildlife by creating barriers to movement of large mammals and by causing injury to them when jumping over or crawling under barbed wire.

Mitigation Measure 3: Seasonally Managed Grazing. Grazing use of riparian areas should be minimized during the dry season when cattle tend to concentrate in moist areas adversely impacting sensitive biological resources such as willow regeneration. A controlled level of grazing that leaves a mosaic of short and tall grasses should be implemented where appropriate. Different levels and seasons of grazing should be varied each year between pastures to allow for maximum structural diversity. Given the identified need to restore woody and herbaceous understory vegetation at the Park, some areas should be removed from grazing at least long enough for vegetation to become well established (2 to 5 years). Wildlife-friendly cattle fencing will be used for new or replacement fence. Such fencing has five wire strands with the top and bottom wires smooth for wildlife and the middle three wires barbed for cattle. The lowest wire is 12 to 16 inches from the ground.

Adverse Impact 4: Recreational User Conflicts. Although incidents resulting in injury to recreational users from cattle are rare, complaints from the public and liability issues are of concern. Most incidents occur when unleashed dogs approach cows with calves, or when people separate calves from their mothers. Bulls can be aggressive towards people who approach too closely. Recreational users may also consider cattle as nuisances due to manure and flies near hiking trails or other recreation areas, and perceptions of damage to natural resources. Livestock operations, on the other hand, may be adversely impacted by hikers leaving gates open that should be closed, or by closing gates that should be left open. Aggressive, unleashed dogs may harm or stress livestock, resulting in economic losses.

Mitigation Measure 4: Education and Restrictions. Concerns from the public should be best addressed through educational displays and signage. The public should be informed to avoid separating cows from calves. Interpretive education should also be offered to explain the benefits of grazing and the Park's dedication to proper management. Displays and educational handouts informing the public about the importance of working landscapes and the agricultural historical landscape should be offered. The public should be asked to keep gates as they found them (open or closed), and hiking stiles may be installed where recreational trails cross livestock fences. Gates should be self closing where possible. Dogs should not be allowed off-leash in actively grazed pastures and leash restrictions enforced. To reduce the potential for injury to people from cattle (which is unlikely), the public should be encouraged to report aggressive animals, and the grazing license terms should require the livestock operator to remove any animal with a complaint as soon as possible (S. Barry pers. com. 2009). Bulls should be kept in recreational areas only as long as necessary for breeding. Livestock concentration areas around water sources, feed stations, and mineral licks should be located away from trails when feasible. Rangeland safety issues (actual or perceived) such as fear of aggressive animals and safety risks from people separating cows from their calves should be addressed in public education programs at the Park.

Adverse Impact 5: Adverse Impacts on Cultural Resources. Livestock grazing may impact cultural resources by directly damaging cultural materials through trampling or by increasing the visibility of such materials to collectors by reducing vegetation cover. As discussed in the Cultural Resources Report (LSA 2007), physical damage to artifacts, features, or midden chemistry can be caused by cattle trampling. Site deterioration, including erosion, can be caused by cattle wallows and trails. These effects are most damaging during wet months when the ground is soft and more susceptible to displacement. The ground disturbance caused by cattle trails, wallows, and trampling, as well as the disturbance needed for the installation of grazing appurtenances such as fences and water sources, could result in a direct adverse effect as defined at 36 CFR 800.5(a)(2)(i) to prehistoric archaeological deposits, historical archaeological deposits, human remains, and minor landscape features. For the purposes of this Study, these features are classified as moderate and high sensitivity cultural resources sites. Moderate sensitivity sites are defined as archaeological sites that displayed minimal signs of disturbance and were not known to contain human remains. High sensitivity sites were essentially the same as moderate sensitivity sites, but with the confirmed presence of human remains. Moderate sensitivity sites could be grazed by livestock if grazing was managed properly to avoid trampling and erosion impacts. FIGR expressed concerns about any grazing by livestock in high sensitivity sites because they consider that the presence of domestic animals over human remains degrades cultural values.

Mitigation Measure 5: Grazing Management and Program Level Mitigation. Grazing management should be implemented to avoid grazing in areas supporting cultural resources that are sensitive to trampling damage during the wet season. High sensitivity sites, should be excluded from grazing except as agreed upon as an alternative vegetation management tool by FIGR. The Regional Park District will coordinate with FIGR to determine acceptable vegetation management techniques for sensitive cultural sites. Program level mitigation measures recommended in the Cultural Resources Study (LSA 2007) should be implemented including the measure to conform to any project-specific standards, guidelines, or procedures developed in consultation with FIGR. Monitoring of moderate and high sensitivity cultural sites should be conducted to detect if livestock grazing is significantly impacting the sites, and corrective measures implemented to avoid or minimize impacts.

4.0 RANGELAND MANAGEMENT PLAN

This rangeland management plan (RMP) describes adaptive management strategies, resource management responsibilities, and rangeland resource goals based on the impact and mitigation criteria provided in the previous section. The RMP includes a grazing management plan that describes general criteria that apply to the entire ranch regardless of pasture configurations, such as livestock lease criteria, recommended kind of animal, and forage supplementation.

An interim grazing management plan is presented that can be implemented with existing pasture configurations as soon as grazing exclosures are installed for highly sensitive cultural resources. This RMP recommends specific resource objectives for each pasture, initial stocking rates, and grazing seasons.

A long-term grazing management plan is presented, which recommends proposed range improvements consisting of alterations in fence locations and water sources to divide the Park into different pasture configurations that are more consistent with resource objectives. Fence lines are reconfigured to form riparian and wetland pastures that could be managed separately from upland pastures. The long-term grazing management plan proposes initial stocking rates and seasons of use for each newly configured pasture.

The RMP concludes with recommendations for management actions for weed control, fuelbreaks, and grassland restoration. Some of these recommendations involve use of grazing as a management tool, while others recommend other means.

4.1 ADAPTIVE MANAGEMENT

Because this plan is intended to provide a long-term framework for resource management of habitat, it is designed to allow for flexibility in response to future technical and scientific advances and changes in species and habitat trends. The RMP provides guidelines and a framework for long-term management. It allows for adoption of new management actions, technologies or practices through coordination among Park management, grazing lessee, and any applicable permitting agencies. The RMP should be considered a “living” document that allows for changes in management actions in response to monitoring results.

4.2 RESOURCE MANAGEMENT

A critical element of successful resource management implementation is oversight by qualified resource management professionals. This RMP recommends that the Regional Parks identify staff positions (assisted as needed by outside contractors) to provide such oversight on a full or part-time basis. The Park Manager and Supervising Ranger III will insure the implementation of the resource management responsibilities that would include:

- Maintaining fencing, livestock water facilities, and signage.
- Coordinating and overseeing trash removal.
- Coordinating and overseeing thatch (RDM) removal and non-native plant species documentation and control (in coordination with the Sonoma County Agricultural Commissioner).
- Reviewing biological/rangeland monitoring data.
- Maintaining records of RMP activities, correspondence, and decisions.
- General inspections of the Park.
- Coordinating and overseeing a yearly biological inspection.
- Recommending and implementing corrective actions to attain the goals of the RMP.
- Coordination with the Sonoma County Mosquito Abatement District to expedite mosquito control measures.
- Ensuring compliance with rules and regulations protecting resource values and coordinating enforcement activities with park rangers and/or the Sonoma County Sheriffs Department.
- Assessing hydrological integrity and erosion.
- Documenting levels of RDM and grazing use patterns.
- Recommending and implementing volunteer educational or habitat restoration programs.

4.3 RANGELAND MANAGEMENT GOALS

The goals of this RMP are the following:

- To maintain an optimal mosaic of vegetation associations (grassland, riparian woodland, oak woodland) to **promote biodiversity**.
    - To maintain and enhance a healthy productive grassland ecosystem with a diversity of native grasses and native wildflowers.
    - To protect and enhance seasonal wetland habitat (including seeps and intermittent streams).
    - To protect and enhance riparian woodland habitat.
    - To protect oak woodland habitat and improve oak regeneration.
    - To control invasive non-native pest rangeland plants (primarily medusahead, Italian thistle, purple star-thistle, yellow star-thistle, and bristly ox-tongue).
    - To maintain and enhance habitat values for native wildlife.
- To **manage wildfire fuel levels** in the open space area's grasslands consistent with County requirements and with other goals of this RMP.
- To allow for viable, **sustainable livestock grazing operations** compatible with overall public recreational usages.

- To minimize conflicts with recreational users and provide interpretive educational opportunities to inform the public about resource management and cultural resource issues including the historical agricultural heritage.
- To avoid or minimize impacts on significant cultural resources.
- To promote a long-term improvement in watershed conditions through minimization of soil compaction, erosion, and sedimentation.

The goals should be examined on a site-specific basis to ensure that they are attainable through sustainable grazing practices. If goals are unrealistic and cannot be achieved economically by livestock grazing operations, such goals may not be attained. One of the challenges of achieving multiple goals is that some goals may conflict with others. For example the best way to achieve the goal of reducing fire hazards is through heavy grazing, but this would conflict with the goals of oak regeneration, riparian woodland enhancement, and water quality which are best achieved through light to conservative grazing. One strategy to achieve multiple conflicting goals includes using effective but sub-optimal approaches (such as moderate instead of heavy grazing to reduce fire severity).

Another strategy is to prioritize goals on a site-specific basis based on geographical locations of resources. The strategies discussed below have been designed to allow for a sustainable economic livestock grazing operation by allowing for a yearlong cow-calf grazing (the current practice). Because management objectives vary somewhat between pastures depending on the location of specific resources and recreational uses, initial grazing use levels and seasons of use will vary. The focus is to select certain areas for initial enhancement while deferring enhancement of other areas to provide for yearlong livestock production. In general, this approach focuses on intensive grazing management initially for enhancement of the more visible and more impacted western portions of the Park while deferring enhancement of the more remote (and less impacted) eastern portions of the ranch. This strategy will not only help achieve resource objectives on a site specific basis, it will provide for the general goal of maintaining species and structural diversity on a landscape level.

4.4 GRAZING MANAGEMENT PLAN - GENERAL CRITERIA

The following provides general criteria that apply to the Park regardless of type and location of range improvements and the configuration of pastures and special management units. These recommendations are not site-specific and are generally appropriate for developing a conservation grazing program for public open space anywhere in the region.

4.4.1 Grazing Lease Criteria

The terms of grazing leases and the lessee selection process can substantially affect progress towards attainment of the rangeland resource goals. The lessee selection process and lease terms should favor a livestock operator who is motivated to help attain the plan goals and will provide incentives towards their attainment. The following criteria, based on standard guidelines for grazing leases on open space lands (EBRPD 2001, EBMUD 2001), have been used to develop a lease program that provides conservation incentives:

- *The lessee selection process will be based on an appraisal method rather than an economic bid system*. Appraisal methods evaluate relevant criteria to select grazing tenants that are qualified and motivated to enhance grassland biodiversity values. Conversely, the economic bid system can encourage economic short cuts and improper grazing practices such as overstocking. Grazing tenant selection for new leases should be based on a proposal and interview process conducted by Regional Parks staff as appropriate. Proposal evaluation criteria for selection of a grazing lessee will include accuracy and responsiveness of the proposal, financial stability, adjacency of existing grazing operations, experience with invasive non-native weed control and revegetation activities, ability to respond quickly to problems, and relevant experience with rangeland conservation practices. The proposal process would not be necessary if the present grazing tenant on the Tolay Regional Park property who has a proven track record for conservation grazing practices wishes to renew the lease.
- *Leases will be awarded for long-terms (at least 5 years)*. Long-term leases provide grazing tenants with incentives against deferring maintenance and management activities. Grazing history interviews for the Greater Jepson Prairie Ecosystem Regional Management Plan (Witham 2006) indicate that livestock operators are more likely to overstock the range when they are uncertain about continuing operations in the following year. Tenure on the land, conversely, motivates the lessee to develop a sustainable operation conducive to attaining resource objectives.
- *Lease fee structures will be based on animal unit months (AUMs), not on acreage*. Because ecological sites vary significantly in forage production, the monetary value of a given area for grazing also varies. Grazing leases based purely on acreage are unfair and encourage overstocking. The lease fee structure will set stocking rates in AUMs and show how they are calculated.
- *Grazing leases will provide incentives for lessees to participate in resource management activities*. The lease fee structure will provide a framework for the lessee to be compensated for labor and materials expended in installing or maintaining range improvements and in conducting biodiversity enhancement activities such as weed control and native plant seeding under direction of the Regional Parks staff. It will also define utilization levels using RDM levels as targets in pounds per acre.
- *The grazing lease will require that the lessee and Regional Parks staff prepare an annual grazing plan (AGP) that is developed to incrementally attain the goals of the GMP.* The lessee will work with Regional Parks staff to develop an AGP each year prior to introduction of livestock. The AGP will identify invasive non-native plant control and native revegetation activities, grazing schedules (including AUMs and pasture rotation schedules), RDM targets, range improvement installation and maintenance activities, and monitoring schedules.
- *The grazing lease will require that the lessee and Regional Parks staff document actual use.* Records will be kept and documented each year in the AGP on the previous year's livestock use including animal types, numbers, and schedules.
- *The grazing lease should incorporate the terms of this Grazing Management Plan.* These terms should be incorporated by reference into the lease so that all parties are aware of their roles and accountable for their responsibilities.

4.4.2 Kind of Animal

Beef cattle (or young dairy cattle) are preferred for grazing the Park for the following reasons: 1) cattle prefer to graze grass rather than forbs (broadleaved plants), so would be more effective in reducing non-native grass thatch and would have less impact on native wildflowers as compared with sheep or goats; 2) there is more demand for beef cattle forage than for sheep or goat forage, allowing more income from leases that could be available for range improvements or ecological restoration (S. Barry. pers. com. 2009); and 3) mature dairy cattle do not spread out or wander as far as beef cattle and must be returned to a barn twice daily for milking.

As an alternative, horses could be allowed to graze as they also prefer grass and there could be enough demand for forage to generate income from leases. Sheep may be accepted; however, grazing seasons may need to be altered and additional infrastructure installed such as woven wire fencing. (lambs can easily pass through barbed wire fencing). Although possibly requiring a subsidy in the future, goat grazing may be useful and cost effective for small scale site-specific weed control treatments by confining goats to infested areas using temporary fencing and water trailers. The Regional Parks may have access to goats and may be able to use them for weed control without having to rent them. Sheep and goats may be an acceptable alternative vegetation management tool for grazing sensitive cultural sites in consultation with FIGR because they weigh less than cattle and thus create less trampling damage.

4.4.3 Supplemental Feeding

Supplemental feeding of livestock with alfalfa or hay can introduce invasive non-native plants and should be closely monitored the following year to detect and control any newly introduced weeds. Mineral supplements, salt licks, or concentrated low moisture molasses/protein supplements are recommended, but locations should be moved periodically and placed away from water sources (at least 1,000 feet where possible) to avoid overuse and provide for more even livestock distribution. Grazing use pattern maps will be used to determine optimal supplement locations (see Figure 3 for an example and Section 5.5.1 for a description).

4.4.4 Range Analysis

A range analysis was conducted to estimate forage production and appropriate stocking rates, based on forage production estimates by range sites from the soil survey and target RDM levels (see Appendix B). The stocking rates calculated by the range analyses are used as a benchmark to establish initial stocking rates for average, favorable (wet), and unfavorable (dry) rainfall years. They can be achieved either by adjusting the grazing season (shorter for dry years) or the number of animals. These stocking rates may then be adjusted (up or down) based upon monitoring results.

The average stocking rates are determined by the number of pounds of forage available in each pasture in an average rainfall year. These base stocking rates are estimates subject to variability due to slope and other factors and may be revised in accordance with periodic monitoring throughout the grazing year. Forage production can be estimated visually based on biomass and grass height data, which would be collected periodically during the grazing season (see Section 5.1 Utilization Assessments).

4.4.5 Flexible Approach

With both the interim and long-term grazing management plans, recommendations should be discussed with the grazing lessee to determine feasibility and should be implemented with flexibility. Grazing use levels are approximate, and should be interpreted accordingly. An actual use level within 250 lbs/ac of the target is acceptable. The seasons of use are also approximate and should be adjusted from year to year based vegetation response to rainfall patterns. These recommendations may also be varied each year; it may be desirable in some cases that the same pasture is not grazed during the same season every year.

4.5 INTERIM GRAZING MANAGEMENT PLAN

This interim plan is designed to allow for implementation with existing fencing (see Section 4.5.1 below for exceptions) and water sources so that proper grazing management is not delayed waiting funding and installation of facilities. It allows for different management strategies (grazing use levels based on stocking rate and season of use) for each pasture depending on specific resource objectives. This plan should be implemented as soon as grazing exclosures are installed to protect sensitive cultural resources (see below).

The grazing lessee is the entity identified to be responsible for adjusting the number of cattle on a feasible schedule to achieve management objectives for RDM. To ensure that the grazing lessee is making those adjustments in a timely manner, oversight should be provided by Regional Parks staff. This section presents the resource and land use priorities for each pasture and recommends initial grazing management regimes (use level and season of use) to help achieve those goals and minimize impacts and conflicts. These initial recommendations should be discussed with the grazing lessee to determine feasibility and should be implemented with flexibility.

4.5.1 Sensitive Cultural and Biological Resources

Cultural Resources. The Park is an important repository for significant cultural resources (LSA 2007), which have the potential of being impacted by grazing. In the past, the property and presumably those resources have been subjected to grazing. However, with the acquisition of the Park by the Regional Parks has come a heightened understanding of the importance of those resources, out of respect for their preservation, and a regulatory requirement as part of federal cultural resources review requirements.

We have classified sites in terms of impacts to grazing as 1) *high sensitivity* requiring wildlife-friendly exclusion fencing, 2) *moderate sensitivity* requiring seasonal grazing restrictions in the wet part of the year, and 3) *low sensitivity* requiring no grazing restrictions. This categorization refers only to the sensitivity of the cultural resource sites to grazing, and not to other potential sources of disturbance.

Prior to grazing pastures with *high sensitivity* cultural resources, LSA recommends that the Regional Parks identify and fence the boundaries of such resources to prevent grazing-related disturbance except as agreed upon by FIGR. This identification should be done by a professional archaeologist in consultation with the FIGR. The fencing may incorporate a 50-foot buffer area around recorded site boundaries based on surface materials if testing is not conducted to determine precise boundaries. A

buffer around the site is not needed if boundary definition excavation is conducted to confirm subsurface boundaries. For the purposes of this grazing plan, we are assuming a 50-foot buffer around each identified site. The areas encompassed by these buffers, which may not be available for cattle grazing, have been subtracted out of the available acreage of the respective pastures.

Because of confidentiality issues associated with cultural resources, the locations of these sites are not illustrated in this public-disclosure document. A separate confidential map and narrative have been provided to the Regional Parks concurrent with the submittal of this report.

Biological Resources. Sensitive biological resources include fragrant fritillary, a CNPS List 1b species, native grasslands, oak woodlands, seeps and other seasonal wetlands, and riparian and pool shore borders. Protection of these sensitive biological resources is addressed by adjustments to the grazing regime as discussed below.

4.5.2 Individual Pasture and Other Management Zone Prescriptions

The interim recommendations are presented below and summarized in Table A. Table B summarizes the grazing carrying capacities for the interim pasture configurations, assuming an average forage production year. See Appendix B for calculations of available forage and animal carrying capacity by pasture. Figure 4 illustrates the interim pasture locations and the distribution of major weed infestations and eroded areas. Figure 5 illustrates the interim pasture locations and the distribution of sensitive biological resources. Figure 6 illustrates the existing range improvements and the interim pasture configurations. Some of the existing water sources shown in Figure 6 (especially those in the western hills pastures) are from springs that dry up in the summer, at least in low or early rainfall years. The grazing prescriptions recommended below therefore may require that these sources be supplemented with larger storage tanks and possibly horizontal wells to tap deeper aquifers to allow for grazing during the prescribed dry season (May-December).

The following prescription is influenced by the tried-and-true past grazing regime under the former owners, the Cardoza's, who grazed about 150 cow-calf pairs when the lakebed and lower terrace fields were farmed and not grazed and up to 250 cow-calf pairs after farming on the terrace fields ceased and they were available to grazing. The lakebed is similarly unavailable for grazing under current conditions, although the terrace fields are available for grazing. The current grazing lessee, H and L Mohring, has been running approximately 200 cow-calf pairs (G. Mohring, pers. com. 2007).

Park Center. No grazing is recommended for the Park Center or headquarters area. This relatively small area does not have good forage potential for grazing. More importantly, this area receives a high level of visitor use and contains cultural and other sensitive resources. Fuel management and weed control should be achieved using measures other than grazing, such as mowing.

Pasture 1: Northwest Hills. Cannon Road, the primary access road to the Park runs through this pasture. Visitor use is anticipated to be high, although most of that use will be people driving through in vehicles as opposed to hikers and other pedestrian use. The priority for providing recreational opportunities must be balanced with a high potential for wildfire ignition and high human and property values. Wildland fuels management should take priority with educational and interpretive displays to inform the public on agricultural and resource issues.

A moderate stocking rate is recommended for the Northwest Hills Pasture grazing to reduce fuel loads. Although this pasture supports native grassland, wetlands, and riparian habitat, these sensitive resources are not extensive or of particularly high quality. On that basis, we determined that this pasture could tolerate a moderate level of grazing in the peak growing season (February-May) which is the recommendation for the interim plan. This recommendation also helps to balance the overall stocking rates on the property, because only one other pasture is recommended for grazing during this period.

Pasture 2: Central West Hills. Fragrant fritillary, which is a California CNPS list 1B species, is especially rare in the Park and occurs in limited numbers in only two pastures (Table A). This perennial wildflower blooms in the period February through March and in some years into April. The plant is particularly palatable to cattle and native deer *(Odocoileus hemionus)*. In both pastures (2 and 3) where this plant occurs in small stands we recommend that grazing be deferred until after the plants have flowered and set seed (after March or April). That will not only allow the fritillary to reproduce by seed, it will provide rest during the active growing season allowing the leaves to photosynthesize and store carbohydrates in the roots and bulbs. That stored energy will allow the plant to recover during the next wet season even if it was defoliated by grazing.

This pasture contains several seeps and associated seasonal wetlands, moist grasslands, and intermittent streams. These wetland features show degradation of vegetation and soils from past heavy livestock use. Much of this damage occurs during the wet season when soils are saturated. The season of use recommended for the fritillary above would avoid grazing during the wettest seasons. However, because the recommended grazing season includes the hot late summer months when livestock tend to concentrate on intermittent streams and damage woody riparian habitat, the following measures are recommended to protect and enhance those habitats:

- Temporary exclusion fencing should be installed to protect willows planted along the streams until established.
- Stocking rates and utilization levels should be light, leaving no less than 1250 lbs/ac RDM at the end of the grazing season.
- The existing water troughs in the Central West Hills Pasture are located in wetlands formed by seeps. Wetland soils and vegetation are impacted by the resulting concentrations of cattle around these troughs. It is recommended that these troughs be relocated to uplands in the vicinity (Figure 8). This would be accomplished by locating the water troughs on uplands at a lower elevation than the current locations, or by using a solar pump to feed water to the troughs.
- Mineral and other supplements should be placed away from wetland areas.

Pasture 3: Southwest Hills. This pasture also supports a stand of fragrant fritillary and we recommend a grazing season from May through December to avoid grazing during the plant's flowering season. This pasture also has riparian and seasonal wetland habitat along South Creek and isolated wetlands and moist grasslands associated with seeps. These features show evidence of vegetation degradation and erosion from past grazing practices. Erosion primarily occurs from trampling when soils are saturated. A light stocking rate during this drier grazing season should help minimize impacts on these resources and water quality. Grazing impacts on woody riparian vegetation can be compensated for by planting and temporary exclusion fencing as discussed in the biological resources study (LSA 2008) and placing supplements away from seeps and streams.

This grazing regime (light from May to December) could also benefit the patches of native perennial grasses (purple needlegrass) by removing competing early annual grass growth and allowing rest in the late spring for the bunchgrasses to recover and set seed. It could also benefit for similar reasons an annual native wildflower, Johnny jump-up, which is a food plant for a special-status butterfly. The recommended grazing regime may also be convenient for the livestock operator, because it would match that of the adjacent Central Hills Pasture so that both pastures could be grazed in common by leaving gates open.

However, this grazing regime is not intensive enough to control the infestations of medusahead, an extremely invasive non-native grass, which is prevalent in this pasture. Control of this species will require intensive grazing management as discussed below (Section 4.7.1).

Lobb's aquatic buttercups, a CNPS list 4 species, also grows in the spring in the Southwest Hills Pasture. It is known from two shallow pools in the spring. No protective measures are recommended for this annual plant at this time. However, the two populations should be carefully monitored in the spring to determine their responses of grazing and if corrective action is required.

A small, but high sensitivity cultural resource site is also located in this pasture. This feature should be fenced off to protect it from cattle trampling damage.

Pasture 4: Tolay Creek. This pasture contains riparian and seasonal wetland habitat around Pond 2 and along Cardoza Creek and Tolay Creek. These features show evidence of degradation from past grazing practices and are prioritized for restoration. Because of the concentration of sensitive riparian and pool-side areas, the high level of erosion and the anticipated intensive visitor use to this management area, and the fact that a grant has been obtained to restore riparian habitat along Tolay Creek, no grazing is recommended in the interim period, which will allow for establishment of riparian restoration planting. This will require development of additional permanent water sources to support livestock in the western hills during the summer when this pasture is traditionally grazed. As discussed under the long-term management plan (Section 4.6), this pasture will eventually be re-configured with a new fence to form a "riparian pasture" so that grazing can be managed to enhance the riparian and pond-side vegetation and protect it from excessive yearlong grazing. The adjacent Pond 1 in the Eastern Hills will also be included in the new fencing configuration. The Tolay Creek Pasture also includes high sensitivity cultural resource sites which should be fenced before grazing is recommenced.

As an exception to this general recommendation of rest from grazing in the interim period until the new fencing is installed, short periods of grazing may be allowed ("pulse grazing") in the late spring for vegetation management at the direction of Regional Parks staff. This would also require fencing to protect the high sensitivity cultural resource site, however.

Pastures 5: North Terrace. Natural resource concerns include extensive infestations of bristly ox-tongue on this formerly cultivated area. Because of its proximity to the Tolay Lake shoreline, this pasture tends to remain wet longer in the season. Grazing before the North Terrace Pasture dries could further compact the clay soils. Accordingly, a moderate stocking rate in the summer and fall (June-November) is recommended to address the heavy weed infestation in this pasture. This may provide control of bristly ox-tongue, because it is palatable to cattle (R. Nichols pers. obs.) and flowers late (July-December) when it would be susceptible to late season grazing as proposed.

Monitoring of the ox-tongue infestation should also be conducted to determine if it is being controlled by grazing.

Pastures 6: South Terrace. This pasture contains sensitive cultural resources. The Cultural Resources Study (LSA 2007) expresses concerns about impacts from trampling damage, especially by concentrated livestock use and trailing when soils are saturated. Because of its proximity to the Tolay Lake shoreline, this pasture tends to remain wet longer in the season, and grazing before the pasture dries could damage cultural resources and further compact the clay soils. Because of the high sensitivity of the cultural resources in this pasture, adequate protective exclusion fencing should be installed before cattle are re-introduced.

Natural resource concerns include the presence of moist grasslands, seasonal wetlands, and extensive infestations of bristly ox-tongue on this formerly cultivated area. A moderate stocking rate in the summer and fall (June-November) is recommended. This strategy has the added advantage of allowing for summer grazing when cattle are removed from other pastures and provide control of bristly ox-tongue. As with the North Terrace Pasture, the efficacy of using grazing to control bristly ox-tongue should be monitored, and alternative methods of control should be implemented if grazing does not achieve the desired reduction of this noxious weed.

The fence between the South Terrace Pasture and the Tolay Creek should be inspected and repaired. The gates should be kept closed to prevent cattle from trailing through cultural sites on the South Terrace Pasture on their way to the Tolay Creek Pasture with Pond 2 for drinking water. Existing water sources along the fence between the North and South Terrace pastures and adjacent to the Eastern Hills Pasture should also be inspected and repaired.

Pasture 7: Eastern Hills. This pasture supports dense oak woodland with large individual oak and bay trees. As discussed in the Biological Resources Study (LSA 2008), evidence of oak regeneration (seedlings and saplings) is lacking. A major objective of the Park is to encourage oak regeneration and formation of a woody understory, which is presently almost entirely absent. Livestock grazing is a factor in decreased oak regeneration, although it may be only one of several interacting factors including wildlife herbivory, weather fluctuations, and competition with annual grasses (McCreary 2001). Livestock grazing impacts on oak regeneration are probably most pronounced in the dry season, when oak foliage is one of the only sources of green forage. Lessening grazing pressure in the drier seasons (e.g., late spring, summer, and fall) is an effective strategy for reducing grazing impacts on oak resources (Wildland Solutions 2007). In addition, this pasture supports many seeps and moist grasslands that could benefit by reducing grazing pressure in the drier seasons, when they are most attractive to livestock.

Under the current configuration of pastures, Pond 1 is included in the Eastern Hills Pasture. Pond 1 supports an extensive margin of riparian vegetation that would be sensitive to grazing pressure. Recreational use, including fishing, is also anticipated to be high at Pond 1.

The spillways from Pond 1 are highly eroded, and there are other eroded areas in this pasture. (Under the long-term rangeland plan, below, the Pond 1 area would be fenced off from the rest of Eastern Hills Pasture.) Native grasslands are also present.

Head cuts along the eastern ridge in the Eastern Hills Pasture have been observed by Regional Parks personnel as the largest source towards visible sedimentation during winter storm events. Cattle grazing appears to accelerate the head cut migration and sedimentation. Exclusion fencing in the relatively small areas that are eroded is recommended. The portions of pasture excluded from cattle grazing should be planted with native shrubs.

Because of the extensive sensitive resources in this pasture, the prescription is for a conservative grazing regime (target RDM of 1,000 pounds/acre) in the wet season (January-April). This grazing regime is designed to maintain acceptable fuel levels. This grazing regime may also serve to control some weed infestations. The pasture should be monitored to see if the elimination of late-season grazing pressure allows for oak seedling regeneration, while achieving fuel reduction objectives.

The Eastern Hills Pasture contains a moderately sensitive cultural resource site. The prescribed wet-season grazing for this pasture would conflict with the prescription of dry-season grazing only for moderately sensitive cultural resource sites. This is a resource conflict that the Regional Parks will address.

Tolay Lake Special Management Zone. This area is to be excluded from grazing under the terms of a grant from the State Wildlife Resource Board. The Cultural Resources Study (LSA 2007) also recommends against any grazing to protect significant pre-historic resources from trampling by cattle. Accordingly, weed control will be limited to water management (flooding), hand methods, and herbicide use.

4.6 LONG-TERM GRAZING MANAGEMENT PLAN

This long-term plan is designed to be phased in as new fencing and water sources are installed. It allows for refinement of management strategies (grazing use levels and season of use) by re-aligning pasture boundaries to incorporate specific resources which would benefit from similar management strategies. The long-term strategy is to create two new riparian pastures through installation of new fencing and water troughs. According to Regional Parks Supervising Park Ranger Brando Bredo (pers. com.), increasing access to water should be a priority range improvement. Installation of water troughs fed from permanent seeps or horizontal wells as recommended is designed to allow increased flexibility in stocking, reduce impacts to natural water sources, and allow for a higher overall carrying capacity on the range.

The long-term recommendations are presented below and summarized in Table C. Table D summarizes the grazing carrying capacities for the long-term pasture configurations, assuming an average forage production year. See Appendix C for calculations of available forage and animal carrying capacity by pasture. Figure 7 illustrates the recommended long-term pasture configurations and the distribution of sensitive biological resources. Figure 9 illustrates the recommended long-term pasture configurations and the existing and proposed range improvements.

4.6.1 Proposed Range Improvements

A new fence is recommended to be installed across a portion of the Southwest Hills Pasture to separate South Creek (Figure 8). This would create a new South Creek Riparian Pasture which could

be served by the existing water trough adjacent to South Creek. The Regional Parks would install wildlife-friendly cattle fencing along the north bank of Tolay Creek and the west bank of Cardoza Creek; existing fencing between the old Tolay Creek Pasture and the old Eastern Hills Pasture will be removed. Additional new fencing will be installed around Pond 1 (formerly in the Eastern Hills Pasture) and existing fence removed above Pond 2 (formerly in the Tolay Creek Pasture) to create a newly configured Tolay-Cardoza Riparian Pasture which encloses both creeks and Ponds 1 and 2. The existing water trough which is located in a seep would be removed and replaced with a new trough on upland to the northeast (Figure 8) with a solar pump if necessary to move water from the former location. Locating additional water sources away from the ponds and removing cattle from this pasture during the dry season should minimize water quality issues because livestock will be less attracted to the ponds. If water quality continues to be impacted, however, temporary fencing may be used to restrict access of cattle to the pond shorelines. The fencing could be located far enough away from the pond to provide a vegetated filter strip between grazing areas and the water.

As discussed above, existing troughs located in seeps in the Central West Hills pasture will be relocated to uplands and provided with water by gravity or solar pumps from seeps or horizontal wells. An abandoned spring development and trough along the southeast boundary of the Park in the Eastern Hills Pasture should be inspected and repaired or replaced if feasible (Figure 8).

4.6.2 Individual Pasture Prescriptions

Pasture 1: Northwest Hills. No substantial changes are anticipated compared to the interim plan. The season of use was adjusted slightly to balance livestock numbers with other pasture's grazing regimes.

Pasture 2: Central West Hills. Once the existing stream sides are revegetated with native woody vegetation (cf. LSA 2008), a greater latitude in the acceptable cattle stocking levels and season of use is anticipated. Long-term revegetation efforts should be undertaken to restore the four intermittent drainages with woody riparian vegetation (cf. LSA 2008). These drainages will continue to be sensitive to grazing pressure, especially when soils are saturated in the wet season. The existing fragrant fritillary stands should continue to be protected by a season of use that is deferred until after the flowering period. The long-term prescription for the Central West Hills is to continue a light grazing regime in the dry season after the fritillary has flowered. Riparian exclusion fencing may be necessary if monitoring detects browsing damage on woody vegetation.

New Pasture 3A: South Creek. This pasture would be formed by installing a cross fence to separate it from the rest of Pasture 3 for the purpose of enhancing the South Creek riparian corridor and seasonal wetland/moist grassland complexes to the west. This configuration also could allow for the entire pasture to be rested from grazing for two or more years to allow for riparian habitat revegetation.

A light stocking rate is recommended during the late spring grazing season (March-May) should help minimize impacts, control fuel levels, and provide enhancement of riparian and wetland resources, and recreational uses.

New Pasture 3B: Southwest Hills. This pasture would be reconfigured to exclude the new South Creek Pasture, as well as seeps and associated seasonal wetlands and moist grasslands. This would

facilitate management strategies on the remaining pasture to favor other resource objectives such sustaining as livestock operations and providing for weed control. A moderate stocking rate with no restrictions on season of use would be favorable for providing flexibility for livestock production as well as for reducing fuel loads and fire hazards. The example in Table C shows a split grazing season (December-February and July-September) to provide forage when other pastures are not used.

This pasture should be targeted for control of the noxious weed medusahead using intensive grazing or other methods (see Section 4.7.1). Weed control strategies need to be balanced with other management objectives, which include for this pasture the restoration of woody vegetation along intermittent drainages and the protection of native wildflowers. If grazing is planned during the fragrant fritillary flowering season (February-April) it should be sheltered with a temporary exclosure, which should be maintained and weeded.

New Pasture 4: Tolay Creek. This pasture is formed by the recommended new fencing as described above to include lower Tolay Creek, Cardoza Creek, Pond 1, Pond 2, and the seeps above Pond 2 into a single management unit (new pasture 4). This newly configured Tolay Creek-Pond Pasture could be managed as a single unit for enhancement of wetland and riparian resources.

A light stocking rate during the late wet season (March-May) should help minimize impacts and provide enhancement of riparian and wetland resources and be compatible with recreational uses. The new configuration also would allow for the entire pasture to be rested from grazing for two or more years to allow for riparian habitat revegetation.

Pasture 5. North Terrace. As with the interim plan, a major emphasis will continue to be non-native weed control. Assuming that the interim moderate grazing regime achieved some control of the bristly ox-tongue, the long-term prescription would be for continued moderate grazing in the late spring, summer, and fall (June-November).

Pasture 6. South Terrace. With the long-term fencing installed to create New Pasture 4, the South Terrace Pasture will be expanded. The prescription of the South Terrace Pasture is to continue moderate grazing in the dry season (June-November).

Pasture 7. Eastern Hills. Acreage of this pasture would be reduced by the creation of the Tolay-Cardoza-Pond Riparian Pasture, which would remove the Pond 1 area. Elimination of this sensitive area would allow for more flexible stocking dates and periods of exposure to grazing, but the long-term objectives of increased oak regeneration, development of a woody understory, and native plant protection will continue. Accordingly, the prescription is to continue a conservative grazing rate (target RDM of 1,000 pounds/acre) during the wet season (October-March).

The Eastern Hills Pasture contains a moderately sensitive cultural resource site. The prescribed wet-season grazing for this pasture would conflict with the prescription of dry-season grazing only for moderately sensitive cultural resource sites. This is a resource conflict that the Regional Parks will address.

Tolay Lake Special Management Zone. In the long-term, we recommend an easing on the blanket restriction of grazing to be negotiated to allow the use of grazing as a weed management tool. Grazing for short periods for resource management objectives (invasive plant control) should be

allowed. We strongly recommend that the policy of excluding grazing from the whole of the Tolay Lake Special Management Zone be revisited with the relevant authorities and stakeholders. The lakebed has been heavily impacted by long history of dry-season farming. Annual cultivation of the seasonally flooded lakebed has perturbed the native soils, encouraging the current near monoculture of weeds under fallow conditions. As the Biological Resources Study (LSA 2008) has documented, the weed cover severely limits the wildlife habitat value of this potentially important resource. Grazing is a practical and cost-effective means of controlling some of these weeds.

Means should be investigated to protect sensitive cultural resources while allowing the use of grazing on the lakebed as a vegetation control method. Such means could include cultural resource surveys to record and clear areas, exclusion of cattle from identified sensitive areas, and seasonal restrictions on cattle grazing.

4.7 OTHER RANGELAND RESOURCE MANAGEMENT

Livestock grazing is one of many tools that can help achieve rangeland management objectives. Although it is usually the most cost-effective, reliable and practical option on a large scale, it should be augmented by other techniques on a site-specific basis in an integrated approach to best achieve resource goals such as invasive non-native plant control, hydrological integrity and erosion control and fire management. Non-grazing strategies for achieving these objectives are discussed below, as well as strategies incorporating grazing as a management tool.

4.7.1 Invasive Non-Native Plant Control

The expansion of existing populations and further establishment of non-native, invasive species threaten the long-term viability of the native ecosystems present within the Park. Invasive plants are defined as those that can spread into wildland ecosystems and displace desirable native species, hybridize with native plants and alter biological communities and ecosystem processes (Cal-IPC 2007). For the purposes of the RMP they correspond with those species listed in Table A of the California Invasive Plant Inventory (Cal-IPC 2007). Specific treatments for target invasive species are discussed below. It should be noted that as target species prioritized for control become less abundant, other species may fill the void. Additionally, new introductions of invasive species could occur in the future. For these reasons, the invasive plant control program should maintain flexibility based on monitoring to adapt to new challenges and opportunities.

Regional Parks staff should assess the extent and location of weedy species within the Park annually and should prescribe and implement appropriate control activities. Control/eradication activities such as physical controls (grazing, mowing, hand-pulling) and chemical/herbicide applications, as deemed appropriate for the species and circumstances of the infestation, should be supervised by Regional Parks staff in an integrated pest management approach.

Herbicides should be applied by a Licensed Applicator in accordance with recommendations by the manufacturer to control some weedy plant species. Usage (including timing and other seasonal restrictions) should be specified and/or modified by Regional Parks staff to minimize applications during periods of high activity by non-targeted species.

Mowing should be timed carefully to remove weed flowers prior to seed ripening. After initial treatments during the first 2 years, mowing schedules should be adjusted by Regional Parks staff using adaptive management based on monitoring results and observations. Mowing height should typically not exceed 3-4 inches. To minimize build-up of thatch and remove non-native seed-heads before they shatter, the mowing regime should use a haying and baling approach with the bales removed from the property to an appropriate location where weed introduction would not pose a threat to biodiversity.

The resource manager should closely follow applicable research on controlling target pest species and incorporate results from that research into the Park's native invasive plant control program. In addition, research on weed management through training goats and cows to select invasive species should be evaluated for use on this site and measures adopted if found effective and feasible (Voth 2006). Areas where weeds have been controlled should be seeded or planted with native perennial grasses to prevent re-establishment of undesirable vegetation. Figure 4 illustrates the major on-site weed infestations. The following initial target species can be controlled (but not necessarily eliminated) through a combination of treatments, as follows:

- ***Medusahead***. A carefully managed combination of prescribed fire, grazing, herbicide treatments and reseeding with native perennial grasses may be the most effective treatment of medusahead (McKell et al. 1962) and should be considered if feasible. In addition to the intensive grazing program discussed above, the following treatments should be implemented. Disking during the boot stage (prior to seed set) is an option, if followed by revegetation with desirable grasses and forbs. Mowing during the boot stage is also an alternative, but the straw would have to be baled and removed to remove seed-heads before they shatter and avoid thatch build-up. Treatment with glyphosate between mid-March and mid-May may also be effective in controlling medusahead.

  Control can be attained through intensive grazing to force livestock to graze medusahead, which could reduce medusahead by up to 90 percent in 2 years of carefully timed treatment (George 1992, George et al. 1989, Wildland Solutions 2005). Over 95 percent control of medusahead can be attained by very high intensity, short-duration (from a few days to two weeks) livestock grazing in the late spring (Doran 2007). High density grazing results in severe competition for forage between animals, forcing them to graze less selectively and more uniformly.

  This treatment is successful only when intensive grazing coincides with the period when medusahead is in the "boot" stage (before the seed head emerges from the uppermost leaf). This intensive grazing treatment should be timed (based on frequent observations by Regional Parks staff) to coincide with the boot-stage phenology of medusahead, which can vary from late April to early May depending on yearly weather fluctuations (Young et al. 1970). This timing is critical because if livestock grazing ceases prior to the boot stage, the plants will re-grow and produce new seed heads. If grazing occurs after the seed head emerges from the boot, the livestock will avoid it because of the sharp awns, and there is a high risk of spreading the infestation by livestock after the seed is ripe. Livestock should be removed as directed by Regional Parks staff when grazing has reached the "heavy" level of use, with RDM levels below 500 lbs/ac.
- ***Italian thistle*.** This vigorous annual is a serious pest plant in the Park and is rated statewide as a moderate threat (Cal-IPC 2007). It reproduces only by seed, which have a high germination rate and can remain viable in the soil as long as 8 years.

Effective control has been obtained using tillage followed by compaction with a roller prior to the first rains to maximize germination of thistle seeds. After the plants have emerged in response to germinating rains, they can be tilled under and the area reseeded with native plants (ESNERS 2000). Grazing by sheep, goats, and horses can be effective in controlling Italian thistle, but cattle need to be trained to graze it (Voth 2006). Application of selective herbicides (Picloram and 2,4,-D) have shown limited success in controlling this species (ESNERS 2000).

- ***Bristly ox-tongue.*** This species is considered a limited threat throughout California (Cal-IPC 2007), but it occurs in dense patches on moist sites on the terraces surrounding Tolay Lake that support little or no native vegetation as a result. At the Park, bristly ox-tongue is a major weed species, forming dense monocultures in the North Terrace Pasture, the South Terrace Pasture, and in the Tolay Lake Special Management Zone (Figure 4). The weed grows in formerly cultivated fields, where the native soil structure has been perturbed by years of plowing. These bristly ox-tongue fields are arguably the areas of least current biological value on the property. Bristly ox-tongue is the most widespread weed on the Park.

  If livestock grazing is not fully effective alone to control these infestations, repeated mowing should be conducted after flowering (April-December) but prior to seed set, with flower parts removed from the site. Small infestations may be controlled by hand pulling or hoeing 2-inches below the surface when soils are moist (ESNERS 2000).

- ***Purple star-thistle.*** Although rated as moderate priority invasive weed (List B) by the Cal-IPC (2007), this species is a high priority for control at the Park because it is more prevalent throughout the Bay Area and creates more impacts than a statewide rating system would suggest. This species, unlike yellow star-thistle, is unpalatable to livestock at all life stages and dense stands of this weed can preclude cattle from grazing (Witham 2006). Therefore, this species causes significant losses of forage and is not effectively controlled by grazing. It is often a biennial or perennial species, with rosettes forming the first year followed by flowering the second and subsequent years.

  Application of glyphosate in the late spring-early summer on the rosettes and early blooming plants after adjacent desirable annual species have set seed is an effective control (Amme 1985). Care must be taken to limit this treatment to areas devoid of native perennials because this herbicide is non-selective. Selective herbicides that are effective in these cases include 2,4,D; Dicamba; or Garlon 3A. Areas to be treated should be mowed in the early spring prior to seed set to remove standing purple star-thistle flowers and to open the treated areas to grazing (Witham 2006).

- ***Yellow star-thistle***. This species is rated as a high priority invasive species by the Cal-IPC (2007). A combination of techniques is most effective in controlling this annual invasive species, including grazing, mowing, burning, herbicide use, and biological controls. Mid to late- spring grazing (May-June), before the plant has produced spines but after bolting, may control seed production and spread to a limited degree (Thomsen et al. 1996). At the discretion of Regional Parks staff, season of use may allow for grazing at specified areas of infestation of yellow star-thistle.

  Where Regional Parks staff determines that infestations of yellow star-thistle are threatening the biological integrity of Park lands, a more focused management approach should be implemented. Under this approach, the infested area could be separated with temporary fencing. Grazing would be postponed within the exclosure to allow growth and elongation of the grasses and yellow star-

thistle, and then high intensity grazing would be applied during the period when yellow star-thistle begins to emerge from the rosette and flower. Repeated treatments would be required to maintain that control. Extra livestock management would be required to keep animals at the site past the normal grazing period, maintain the fencing, and manage the animals. If Regional Parks staff deems it appropriate, sheep or goats may be used instead of cattle for intensively managed grazing treatment of invasive species. In small areas where grazing is not feasible, mowing during the same period should be used to control yellow star-thistle.

- ***Himalayan blackberry.*** Himalayan blackberry grows most often in the understory of riparian areas where it forms impenetrable stands among the lower branches and trunks of the willow trees. It also grows as compact stands in a few grassland areas and at the head of unvegetated watercourses. When in riparian situations, it dominates the understory, appears to spread, and may exclude other species. Himalayan blackberry, however, provides excellent cover for wildlife especially considering the relative absence of cover at Park.

  Recommendations entail control by either hand removal or use of goats. Control should be phased such that alternative understory plant species would be established nearby prior to removal of a stand or portion of a stand of Himalayan blackberry. In this manner, cover would be maintained for wildlife. Given its value as vegetation cover for wildlife, control of Himalayan blackberry should be given a low priority compared to the other invasive species listed above.

- ***Water primrose.*** As discussed in the Biological Resources Study (LSA 2008), water primrose is a perennial species that appears to grow only in the Duck Pond (Figure 3). This high aggressive species covers all but a small area in the center of the pond by summer. Water primrose is an emergent species with much of its biomass growing above the surface of the water. Water primrose should be controlled before it becomes inadvertently established in other areas of the Park. It will displace native species and its decomposition will contribute to the eutrophication of waterbodies.

  The relatively small size and accessibility of the Duck Pond would facilitate the treatment of the water primrose with herbicide from the shore. Multiple treatments may be required for at least the first year with follow-up treatments the following approximately 5 years, if a bank of long-lived seeds has developed. Because water primrose is a perennial plant, mechanical cutting of the stems will result in re-growth and not control. Excavation of the Duck Pond may remove most of the water primrose, but there would be a need to dispose of the excavated material and a need for follow-up treatments.

  Eradication of water primrose should be a high and immediate priority. This plant is highly invasive and could spread beyond the Duck Pond to Tolay Creek. Once in the creek, it would be nearly impossible to control and would cause inestimable environmental damage. (See http://www.lagunadesantarosa.org/programs_rp_isc_lmp.shtml for the environmental damage water primrose is causing in the Laguna de Santa Rosa.)

- ***Water smartweed.*** As discussed in the Biological Resources Study (LSA 2008), water smartweed is a perennial species that covers the surface of the dried bed of Tolay Lake and Tolay Creek immediately below the lake. It also occurs further downstream in Tolay Creek and upstream of Tolay Lake. Water smartweed grows from perennial roots in the late spring and is the dominant cover by the time that the lake is dry. It may grow so thickly as to inhibit the foraging of ducks in Tolay Lake. Cultivation of the dried bed of Tolay Lake resulted in cutting the roots and spreading them throughout the lake bed. This contributed to the dominance of water smartweed within

Tolay Lake. Because of its widespread distribution, it would be nearly impossible to completely remove water smartweed from the Park.

Recommendations include monitoring the cover of water smartweed in Tolay Lake. If the cover of water smartweed continues to impede the use of the lake by wildlife, then treatment options should be considered. At least two options are available for control of water smartweed in Tolay Lake. The first option would entail grazing Tolay Lake. Cattle could be provided with seasonal access to Tolay Lake in order to reduce the density of water smartweed. If cattle do not provide sufficient control, then a glyphosate-based herbicide could be used.

- ***Poison hemlock***. As discussed in the Biological Resources Study (LSA 2008), poison hemlock grows in relatively small stands along the upper banks of Tolay Creek, along the bank of Eagle Creek, and possibly in other areas of Tolay Lake Regional Park. Poison hemlock typically excludes other species from occurring within its dense single-species stands. This weed tends to grow in areas that have been previously disturbed.

  Recommendations would be to control by cutting in late spring. Because poison hemlock is an annual plant, removal just before seed set should result in and almost complete control of the current year's growth. Follow-up control will be necessary until the residual seeds in the soil have been depleted.

- ***Other invasive species***. Other invasive non-native plants that have been identified on the Park include bull thistle (*Cirsium vulgare*), prickly lettuce (*Lactuca serriola*), and milk thistle (*Silybum marianum*). These should be inventoried and considered for control when they present a significant management problem, show evidence of rapid spread, or when they become priority targets as other higher priority invasive species are controlled. These other species should also be watched because they could spread into available niches once occupied by invasive species that have been controlled.

4.7.2 Fuel Breaks

Fuelbreaks (where vegetation is thinned or mowed) are generally preferred by park and open space districts in the Bay Area to firebreaks, where soils are disked or bladed to bare ground. Because of the high levels of ground disturbance and elimination of competitive native or naturalized vegetation, firebreaks often support dense stands of invasive non-native plants such as yellow star-thistle, which often provide higher fuel levels than the original grasslands. In addition, firebreaks are prone to erosion because of lack of vegetation cover and roots. Many open space managers have determined that livestock grazing and/or mowing can be as effective as disking if planned properly, as shown by the following examples:

- Both the East Bay Regional Park District and the Marin Open Space District do not disk firebreaks and instead promote livestock grazing and/or mowing for fuels management.
- Maintenance staff at Olompali State Historic Park maintain a fuel break of mowed grass, 100-feet-wide, along the freeway. A fire in 2006 burned to the edge of the mowed area but it was slowed down enough to allow for deployment of the fire department who successfully stopped the fire.

- The City of Fairfield's Serpa Ranch Rolling Hills Open Space originally called for a 100-foot-wide perimeter fire break, but the ranger determined that livestock grazing was adequate to reduce the fire hazard, and the fire break was not installed.
- A fire behavior model (BEHAVE) for the City of Fairfield's Rockville Hills Open Space determined that in the most likely fire scenario (Diablo wind late in the fall during a drought), a firebreak would be ineffective in stopping a wildfire, and that livestock grazing was the most practical and effective approach to fuels management.

Currently, fire breaks (except existing roads and powerline corridors) do not exist on the Park and it is recommended that none be created unless such breaks are required by the County Fire Department or other applicable regulatory entity and/or monitoring indicates that periodic wildfires are having adverse effects on the biological resources within the Park. If the creation of fire breaks becomes necessary, the following measures will be implemented:

- Prior to fire break construction, "no disk zones" should be established in areas of sensitive habitat such as riparian corridors, wetlands, native grasslands and special-status species occurrences. The "no disk zones" should be permanently staked and signed; using metal fence posts placed at least 50 feet from the edge of the sensitive habitat. A sign (No Disk Zone) should be installed at strategic points to alert the disk operator of the presence of the sensitive habitats.
- In areas designated as a "no disk zone," the disk operator should raise the disk-blades and cross the restricted zone. The disk-blades must not be lowered until the blades are beyond the No Disk Zone sign on the opposite side of the sensitive habitat. In no case should the operator allow the blades to touch the soil while in the restricted zone.
- "No disk zones" may not be crossed if there is standing water or if the soil is wet. In such cases, the disk operator must raise the blade and make a detour around the pool/swale or other type of wet area. A resource ecologist or ranger shall determine the best route around a pool/swale area.
- "No vehicle access" areas should be identified concurrently with establishing the "no disk zones." Detour routes should be identified on site maps to allow for access to the fire break routes while avoiding sensitive species habitat. "No vehicle access" areas should be identified in the field by temporary signs, arrows, and flagging placed at detour points at least one week prior to fire break construction.
- "No disk zones" in some habitats may have vegetation that compromises the fire break's effectiveness. If tall or dense vegetation occurs in a "no-disk zone," the vegetation should be mowed and the clippings removed after the seeds of native plants have dropped. The clippings should be removed either by hand using rakes, or with equipment that lifts them off the surface without removing the surface soil.
- In general, creation of fire breaks shall occur near the end of the growing season (May or June) and no later than July 1. Disking should be timed to discourage weeds. The ideal time to disk would be after the weeds flower but before the seeds ripen.
- Incorporate existing roads or other linear clearings into firebreaks as much as possible to minimize impacts. An effective option would be to mow 35- to 50-foot-wide strips on each side of existing dirt roads.

4.7.3 Native Grassland Restoration

Native grasses, primarily creeping wildrye (in moist grasslands) and purple needlegrass, occur sparingly in patches throughout the Park (Figure 5). The grazing regimes outlined above may promote the growth of native grasses, as the timing of grazing may allow for the production of seed from native grasses and a reduction in seed produced by non-native species. The density of stands of these grasses should be assessed by Regional Parks staff, who should recommend seeding or plug planting on a site-specific basis, especially in barren areas where weeds have been controlled or erosion treatments installed. The following recommendations are derived from the California Native Grassland Association Restoration Workshop (CNGA 2006).

For native grassland restoration to be successful, it is imperative that site preparation be conducted to control competing vegetation (especially non-native annual grasses), diminish their soil seed bank, and prepare a good seed or planting bed. This requires initial treatment using tillage or herbicide, preferable on a repeated basis, to germinate non-native seed and kill the emerging non-native annuals before the seed ripens, thus depleting the soil seed bank.

Planting of native grass plugs is the most successful (and most expensive and labor intensive) method for restoration because the grasses have already been established and can compete better with weed seedlings. Another advantage of plug planting is that a pre-emergent herbicide may be applied prior to planting to further suppress competing weeds. Plugs are available in 200-plug trays in 1¼-inch-by-1¼-inch-by-2½-inch cells. They are most efficiently planted using crews of three (trained volunteers are appropriate); one worker makes a hole with a dibble, the second places the plug in the hole, and the third pinches the holes closed (important to prevent desiccation of the plug). Plug planting is usually done in staggered rows. Closer spacing may be desirable where fast cover and weed suppression are goals.

Seeding is less successful because native grass seedlings are tiny and grow slowly, hence are easily smothered by fast growing annuals. For this reason vigorous site preparation is necessary to minimize non-native annual growth. The most effective method of native grass seeding is using a rangeland drill because it covers the seed with soil. However, drill seeding is limited to gentle slopes without rocks. Hydroseeding with wood mulch is the best alternative for steeper or rocky slopes.

Native Grassland Restoration Seed Mix for Fast Cover (Erosion and Weed Control). Native grass species selection depends on the site and objective of the seeding. If the objective is to attain rapidly establish a “cover crop” to control erosion and compete with weeds, the following commercially available annual or short-lived perennials should be considered:

Common Name	Scientific Name
‘Cucamonga’ brome	*Bromus carinatus*
Three-weeks fescue	*Vulpia microstachys*

Mesic Native Grassland Restoration Seed and Plug Mix. For restoration of moist grasslands, seasonal wetlands and seeps, the following species should be considered with plugs of native rushes (*Juncus spp*.) and sedges (*Carex spp*.) in the wettest areas:

Common Name	Scientific Name
California oatgrass	*Danthonia californica*
Meadow barley	*Hordeum brachyantherum*
Creeping wildrye (plugs only)	*Leymus triticoides*
California semaphore grass	*Pleuropogon californicum*

Upland Native Grassland Seed and Plug Mix. The principal component of native grasslands on dry slopes is purple needlegrass. However, diversity can be augmented by including one or more of other native grass species. The following are native to grasslands in the region.

Common Name	Scientific Name
Blue wildrye	*Elymus glaucus*
California melic	*Melica californica*
Torrey melic	*Melica torreyana*
Purple needlegrass	*Nassella pulchra*

It is recommended that native forbs (wildflowers or legumes) not be included in the seed mix or planted with plugs. It is difficult enough to establish native grasses from seed without adding competition from native annuals. If desired for visual or biodiversity purposes, native forbs should be seeded or planted after the native grasses have become well established (2-3 years), preferably following treatment with a broadleaved selective herbicide to reduce non-native forb competition.

4.7.4 Rodent Control

Burrows created by rodents such as California ground squirrels *(Spermophilus beecheyi)* or Botta's pocket gopher *(Thomomys bottae)* are important to the survival of several other native animals, including burrowing owl *(Athene cunicularia)*. However, ground squirrels in particular can become pests where people feed them, can carry the plague, and their presence can conflict with adjacent agricultural land users.

Control of rodents should be judicious with the overall goal of reconciling public safety with wildlife habitat benefits. Use of gas to control rodents is not recommended. Cultural methods such as educating the public to refrain from feeding ground squirrels should be encouraged. Ground squirrels prefer short grass areas and may be discouraged from using an area if vegetation is allowed to grow tall and rank. Control activities using poison bait, if undertaken, should be within the parameters prescribed by the County Agricultural Agent.

5.0 MONITORING

Monitoring is required to determine if the rangeland management plan is being implemented properly (compliance monitoring), and to measure progress towards meeting the goals and objectives (effectiveness monitoring). Compliance monitoring is used to ensure that the terms and conditions of the grazing lease are being followed (Bush 2006). It includes visual inspections of range improvements (e.g., fencing, water sources) to ensure that they were installed and/or maintained properly. It also includes an assessment of "actual use," which is done by comparing the records the lessee provides of numbers, kinds, classes, and periods of livestock in each pasture with Regional Parks staff's observations. The most important form of compliance monitoring for managing livestock grazing is to gather and assess data to determine if the use levels for each pasture are consistent with the lease terms and the grazing strategies agreed upon by the Park and the lessee.

5.1 COMPLIANCE MONITORING

5.1.1 Visual Monitoring - Recommended

This monitoring program should be based on visual assessments of the vegetation during the grazing season to ensure that desired grazing levels are not exceeded. Monitoring visits would be made twice per grazing season: once in the fall (September or October) at the end of the grazing season to determine if the RDM targets were attained, and once in the spring during the growing season to determine if stocking rates need to be adjusted (upward or downward). Assessments of the grass height and RDM standards should be based on an average of multiple visual estimates distributed across the property in "key areas" (see definition Appendix A) that reflect the pasture as a whole.

Based on the ecological sites (Section 3.1), the recommended minimum number of key areas to be monitored in each pasture or management unit to assess RDM levels is as follows:

	Number of Key Areas	
	Interim plan	**Long-range plan**
Park Center	0	0
Northwest Hills	1	1
Central West Hills	2	2
South Creek Riparian	n.a.	2
Southwest Hills	4	2
Tolay Creek	3	3
North Terrace	2	2
South Terrace	2	2
Eastern Hills	4	4
Tolay Lake Special Management Zone	2	2
Total	20	20

Residual cover use patterns should also be mapped on standard aerial photographic base maps of the property at the time of the fall monitoring visit. This mapping; based on RDM visual estimates (see below) summarized under the use categories of light, moderate and heavy; may be used to document livestock distribution and resulting grazing use levels throughout each pasture. Use pattern maps provide a valuable tool for assessing the potential need and location for additional improvements (cross fencing, water, mineral supplements, etc.) to improve livestock distribution. An example of a use pattern map from 2006 is provided in this report (Figure 3), but this map is not representative of a typical grazing pattern because cattle were removed earlier than usual that year. Use pattern mapping may not be needed every year unless new improvements have been developed or other factors change livestock distribution.

Estimates can be facilitated using an RDM Monitoring Photo-Guide developed by Wildland Resource Solutions (Guenther 1998) using the following six utilization classes:

RDM is between 1,000 and 1,250 lbs/ac. Rangeland may show evidence of considerable use. Seed stalks may be heavily utilized. Ground cover by vegetation is essentially 100 percent complete. Little bare soil is apparent, except for occasional pocket gopher activity and livestock/game trails. A Robel Pole would be obscured to a height of 2 to 4+ inches. Golf ball sized objects may be partially visible at a distance of 10 feet, but seldom visible at a distance of 20 feet. This use class represents conservative to light grazing.

RDM is between 750 and 1,000 lbs/ac. Rangeland typically shows clear evidence of grazing use. Seed stalks may be heavily utilized or trampled. Some bare soil is apparent, including pocket gopher activity, from 20 feet. A Robel Pole would be irregularly obscured to a height of 1 to 2+ inches. Many golf ball sized objects are partially visible at a distance of 10 feet, and some may be barely visible at a distance of 20 feet. This use class represents moderate to conservative grazing use.

RDM is between 500 and 750 lbs/ac. Rangeland shows evidence of extensive grazing use. Residual vegetation is patchy with some areas grazed to less than 1 inch and other areas with 3 to 5 inches of vegetation remaining. Some bare soil is apparent. A Robel Pole would be partially obscured at a height of 1 to 2 inches. Many golf ball sized objects are clearly visible at a distance of 10 feet and most are visible at a distance of 20 feet. This use class represents heavy to moderate use levels.

RDM is between 250 and 500 lbs/ac. Rangeland shows evidence of extensive grazing use. Standing seed stalk are scarce; some seed stalks occur as litter on the ground. Ground cover is sparse and clumpy; large areas are grazed to about 1 inch; scattered areas of 3 to 5 inch vegetation exist. Some bare soil is readily apparent. A Robel Pole would be fully visible. Most golf ball sized objects are clearly visible at a distance of 10 feet and most are visible at a distance of 20 feet. This use class represents very heavy grazing use and if continued could result in rangeland degradation. One to 2 years at this level is appropriate for intensive grazing management such as for control of medusahead.

RDM is between 125 and 250 lbs/ac. Rangeland shows evidence of extreme grazing use. Residual vegetation is scarce with most areas uniformly grazed to 1 inch or less. Standing seed stalks are rare; however, seed stalks and seed heads occur as litter. Bare soil is obvious. A Robel

Pole would be fully visible. Golf ball sized objects are clearly visible at distances of 10 and 20 feet. This use class represents overgrazing and will eventually result in rangeland degradation.

RDM is less than 125 lbs/ac. Rangeland shows evidence of total use. No standing seed stalks remain. Some seed stalks and seed heads occur as litter on the ground. Most areas are grazed to less than 1 inch. Considerable bare soil is readily apparent. Golf ball sized objects are clearly visible at 20 feet. This use class represents severe overgrazing and will result in rangeland degradation.

5.1.2 Quantitative Monitoring - Supplemental

The visual estimates of RDM levels described above may be confirmed and calibrated by clipping plots in key locations in each grazing unit (Bartolome et al. 2002). For most purposes, this labor intensive method is not recommended for Park management.

Quantitative monitoring, if conducted, would entail placing a 0.96 sq. ft. quadrat on the ground, removing all summer annuals from the quadrat, clipping the remaining plant material as close to the ground as possible without disturbing the soil surface, and weighing the dry plant material. The RDM levels at each plot location may be documented each year by photographs from permanent photo stations. Representative photographs of the RDM levels in each community type should be taken annually.

5.2 BIODIVERSITY MONITORING

5.2.1 Recommended Biodiversity Monitoring

In addition to monitoring for determination of grazing use levels, species composition of grasslands should be assessed. This can be done on an informal, visual basis by the Regional Parks staff. Quantitative studies, of course, provide much more reliable data but are costly and may not be necessary to meet immediate Park management goals.

Biodiversity monitoring is labor intensive and expensive, so it does not need to be conducted every year. An initial monitoring study could be conducted as a baseline in the first year of mitigation, and continued yearly during the first 3 years after management actions, thereafter every 5 years, for example. The methodology described below is to be used only as a general guideline. Data from other open space monitoring programs should be analyzed to determine if similar data can be obtained from a less intensive sampling protocol.

5.2.2 Supplemental Biodiversity Monitoring

To conduct a quantitative effectiveness monitoring program to assess biodiversity at the Park, a detailed study plan should be drafted. One potential technique would be to use permanent belt transects, located and marked using GPS (global positioning system) technology for recording all of the grazing pastures. The transects would then be subdivided into segments for data collection and analysis. Percent cover of target species would be estimated and assigned to cover classes. Small

populations of invasive weeds or native target species outside of the transects that are not encountered inside the transects would be mapped using GPS receivers.

Target species for monitoring would include fragrant fritillary, native grasses such as purple needlegrass, and early perennial forbs such as Johnny jump-up. Monitoring results would be used for assessing adjustments to management activities such as weed control, grazing management, or revegetation. Monitoring results could also be used to determine locations for range improvements such as water sources, fencing, and supplements.

Cover mapping/monitoring could be conducted for larger stands of native grasses and invasive plant species. The boundary of these stands would be mapped using a GPS unit. The boundary would be monitored every three or so years to examine the status of the stand and to determine whether the stand is increasing or decreasing in size. Randomly located small plots may be used to sample the density of invasive plants, native grasses, and associated species in selected areas.

5.3 ADAPTIVE MANAGEMENT AND CONTINGENCY MEASURES

Based on monitoring results, changes in management prescriptions may be needed. For example, if deficiencies in achieving grassland management objectives are noted, applicable measures would be implemented to meet residual cover and height requirements and/or provide better distribution of grazing pressure. These measures could include measures such as changes in stocking rates, season of grazing, additional internal or exclusionary fencing, and relocation of water or supplements. Changes in prescriptions may also be made in response to emergency situations (e.g., fire, flood, severe damage to facilities) by the Regional Parks staff.

5.4 MONITORING REPORT

Annual monitoring reports should be prepared to document management activities, assess performance, identify problems, and recommend management actions. The Regional Parks staff in coordination with the grazing lessee could prepare the reports. The reports may include the following information:

- Description of any changes to the methodology employed during the past year of monitoring.
- Summary of results of the annual monitoring studies.
- Copies of data sheets and monitoring photographs.
- List of persons who participated in the monitoring and preparation of the annual report.
- List of persons receiving the report.
- One-page summary of the report contents.
- Summary of grazing actions during the preceding year.
- Summary of other management actions undertaken during the preceding year.
- Recommendations for modifications to the plan.

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FIGURES

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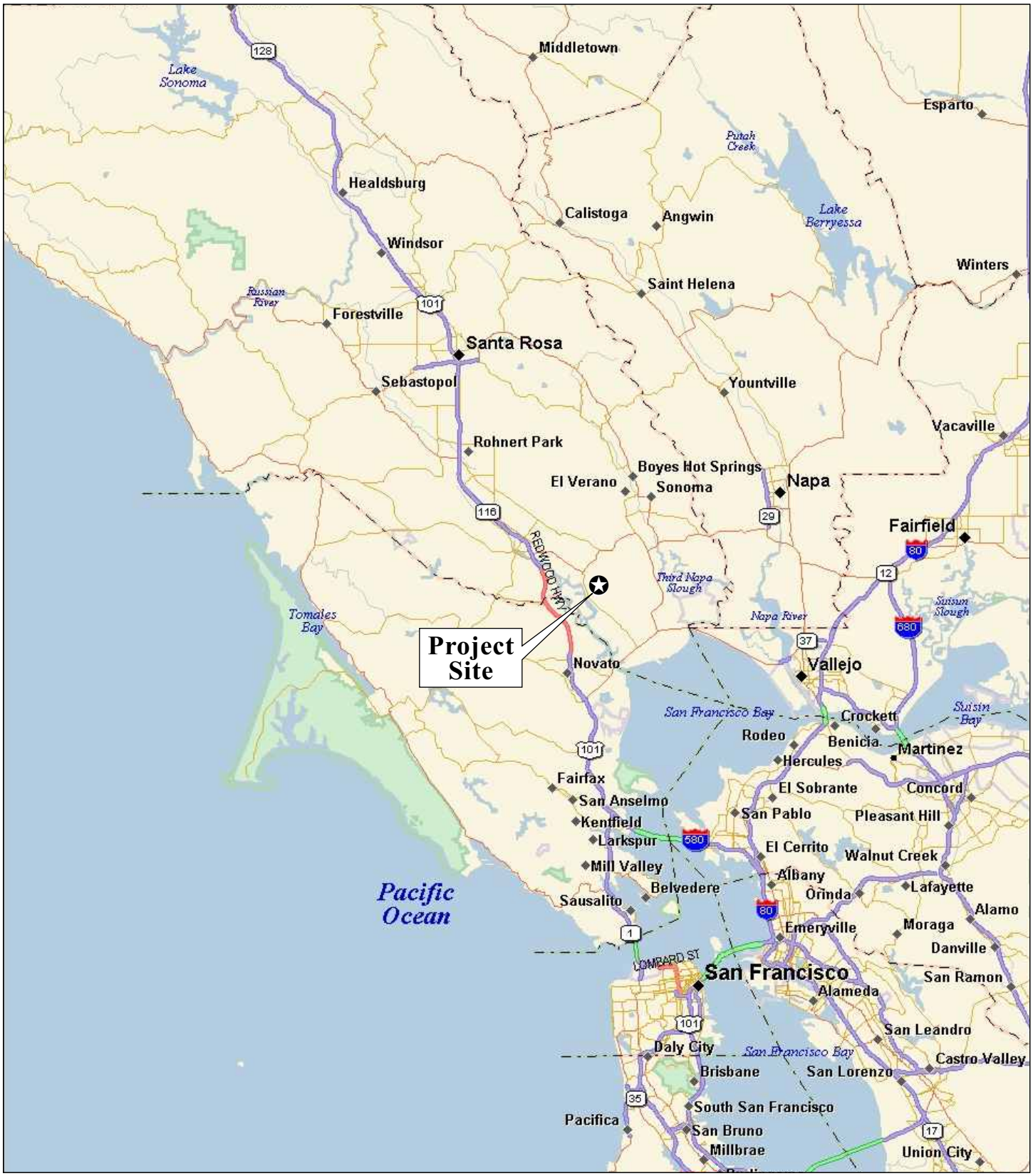
Figure 6: Sensitive Biological Resources and Interim Pasture Configurations
Figure 7: Interim Pasture Configurations and Existing Range Improvements
Figure 8: Sensitive Biological Resources and Long-term Pasture Configurations
Figure 9: Long-term Pasture Configurations and Existing and Proposed Range Improvements



LSA

FIGURE 1

Tolay Lake Regional Park
Rangeland Resources Study

Regional Location

N

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MILES

SOURCE: ©2006 DeLORME. STREET ATLAS USA®2006.

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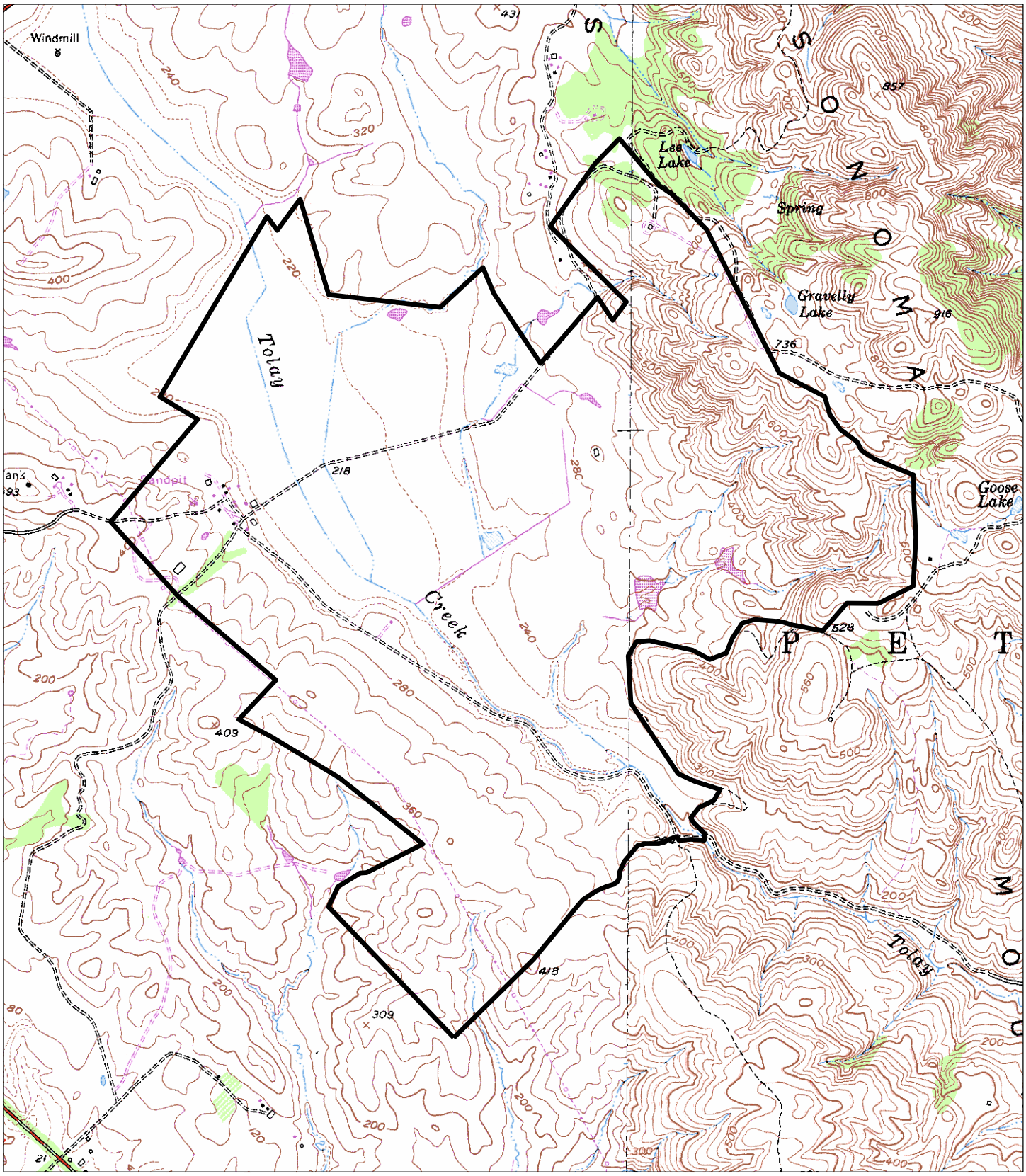


LSA

FIGURE 2

Tolay Lake Regional Park
Rangeland Resources Study

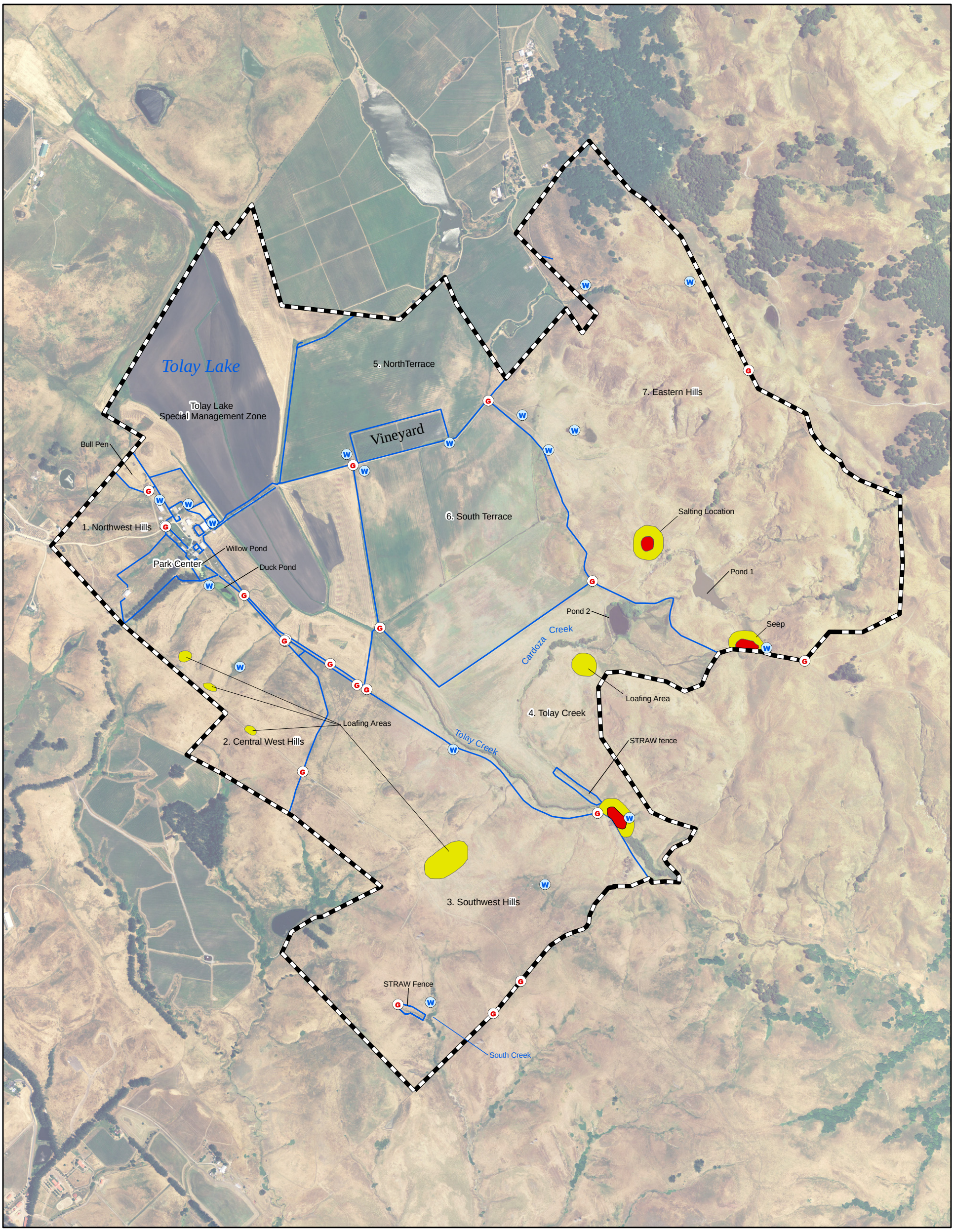
Study Area

N

0 500 1,000 2,000
FEET

SOURCE: USGS 7.5-minute Topos Petaluma (1980) and Sears Point (1968).

I:\SOG0601\GIS\Maps\Figure2_Study Area.mxd (10/02/2007)



LSA

FIGURE 3

Tolay Lake Regional Park Boundary
Long-term Management Areas
Existing Fence
Existing Gate
Existing Water Trough
Area of High Grazing Intensity
Area of Medium Grazing Intensity
Area of Low Grazing Intensity

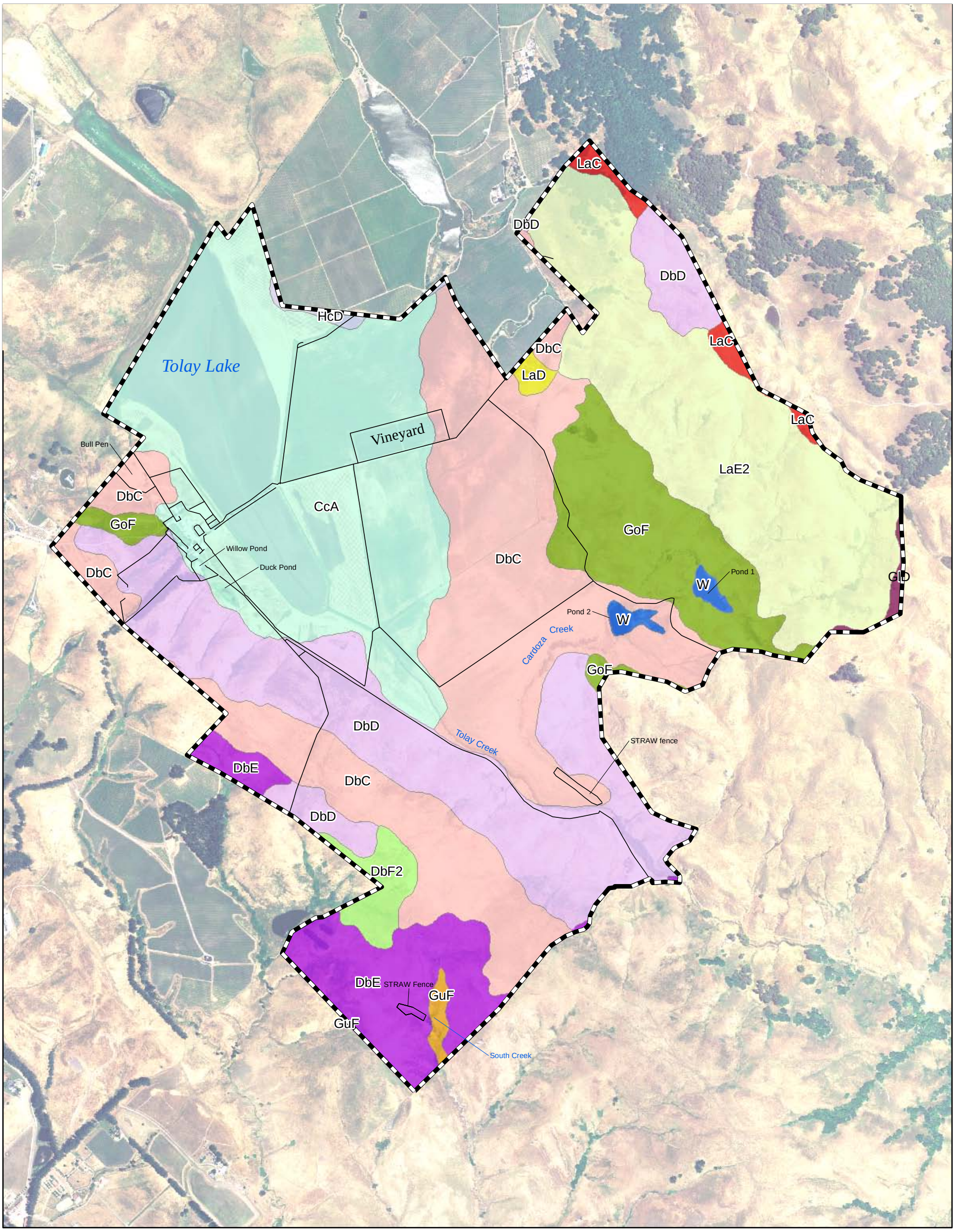
Rangeland Resources Study
Tolay Lake Regional Park

0 0.125 0.25
MILES

Grazing Use Pattern 2006

Source: Aerial Photo from the USDA, National Agriculture Imagery Program (2005)

I:\SOG0601\GIS\Maps\Figure3_Grazing Use Pattern.mxd (03/13/2009)



L S A

FIGURE 4

Tolay Lake Regional Park Boundary Perimeter Fence

Existing Fence

0 0.125 0.25
MILES

Color	Map Unit	Soil Map Unit
	CcA	Clear Lake Clay Loam, 0-2% slopes
	DbC	Diablo Clay, 2-9% slopes
	DbD	Diablo Clay, 9-15% slopes
	DbE	Diablo Clay, 15-30% slopes
	DbF2	Diablo Clay, 30-50% slopes, eroded
	GID	Goulding Cobbly Clay Loam, 5-15% slopes
	GoF	Goulding-Toomes Complex, 9-50% slopes
	GuF	Gullied Land
	HcD	Haire Clay Loam, 9-15% slopes
	LaC	Laniger Loam, 5-9% slopes
	LaD	Laniger Loam, 9-15% slopes
	LaE2	Laniger Loam, 15-30% slopes, eroded
	W	Water

Rangeland Resources Study
Tolay Lake Regional Park

Soils

Source: Aerial Photo from the USDA, National Agriculture Imagery Program (2005), Soil Data modified from the Natural Resources Conservation Service

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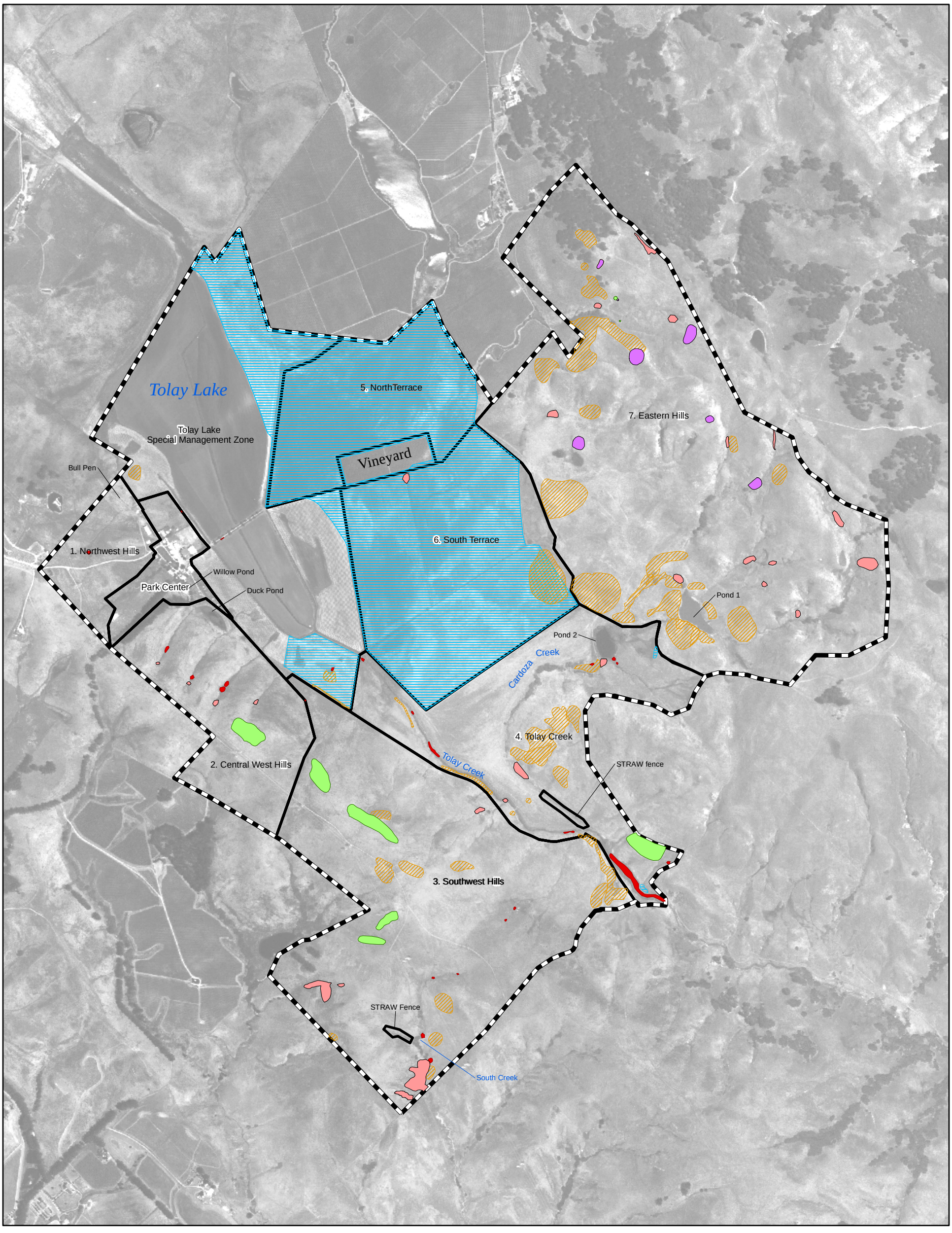

LSA

FIGURE 5

Tolay Lake Regional Park Boundary
Interim Management Areas
Italian thistle (*Carduus pycnocephalus*)
Star-thistle (*Centauria* spp.)
Erosion
Medusahead (*Taeniatherum caput*)
Bristly ox-tongue (*Picris echioides*)
Himalayan blackberry (*Rubus discolor*)

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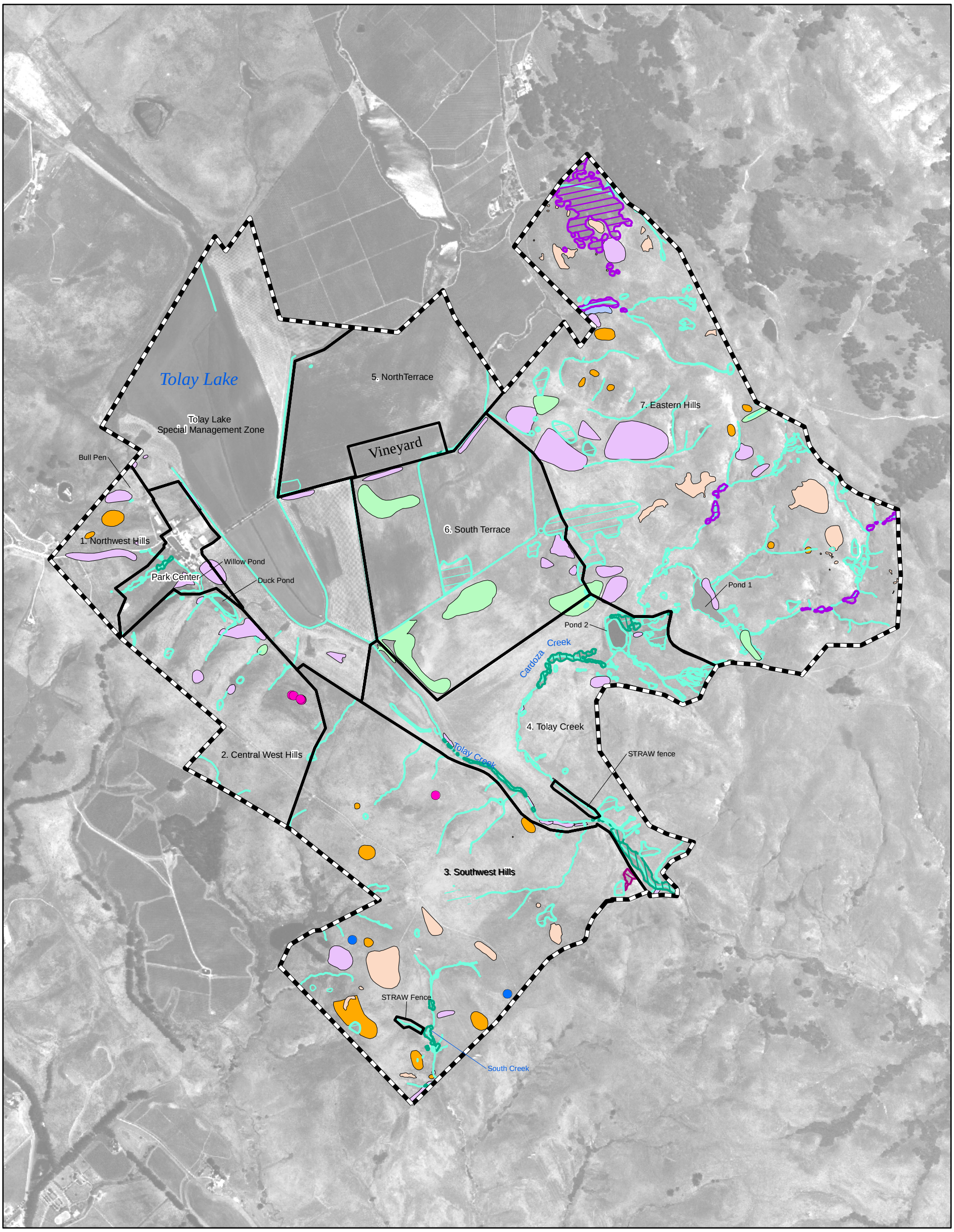
0 0.125 0.25
MILES

Rangeland Resources Study
Tolay Lake Regional Park

Major Weed Infestations, Eroded Areas, and Interim Pasture Configurations

Source: Aerial Photo from the USDA, National Agriculture Imagery Program (2005)

I:\SOG0601\GIS\Maps\Figure5_Weeds.mxd (01/14/2008)



LSA

FIGURE 6

Tolay Lake Regional Park Boundary
Interim Management Areas
Wetland
Stream Segment/Culvert
Oak Woodland
Riparian Woodland
Buckeye Woodland

Moist Grassland (*Danthonia, Leymus, Hordeum*, etc.)
Semaphore Grass Wetland (*Pleuropogon californica*)
Johnny-Jump-up (*Viola pedunculata*) Native Wildflower Field
Purple Needlegrass Grassland (*Nassella pulchra*, etc.)
Mixed Native Wildflower Field (*Platystemon, Lithophragma*, etc)
Fragrant Fritillary (*Fritillaria liliacea*)
Lobb's Aquatic Buttercup (*Ranunculus lobbii*)

N

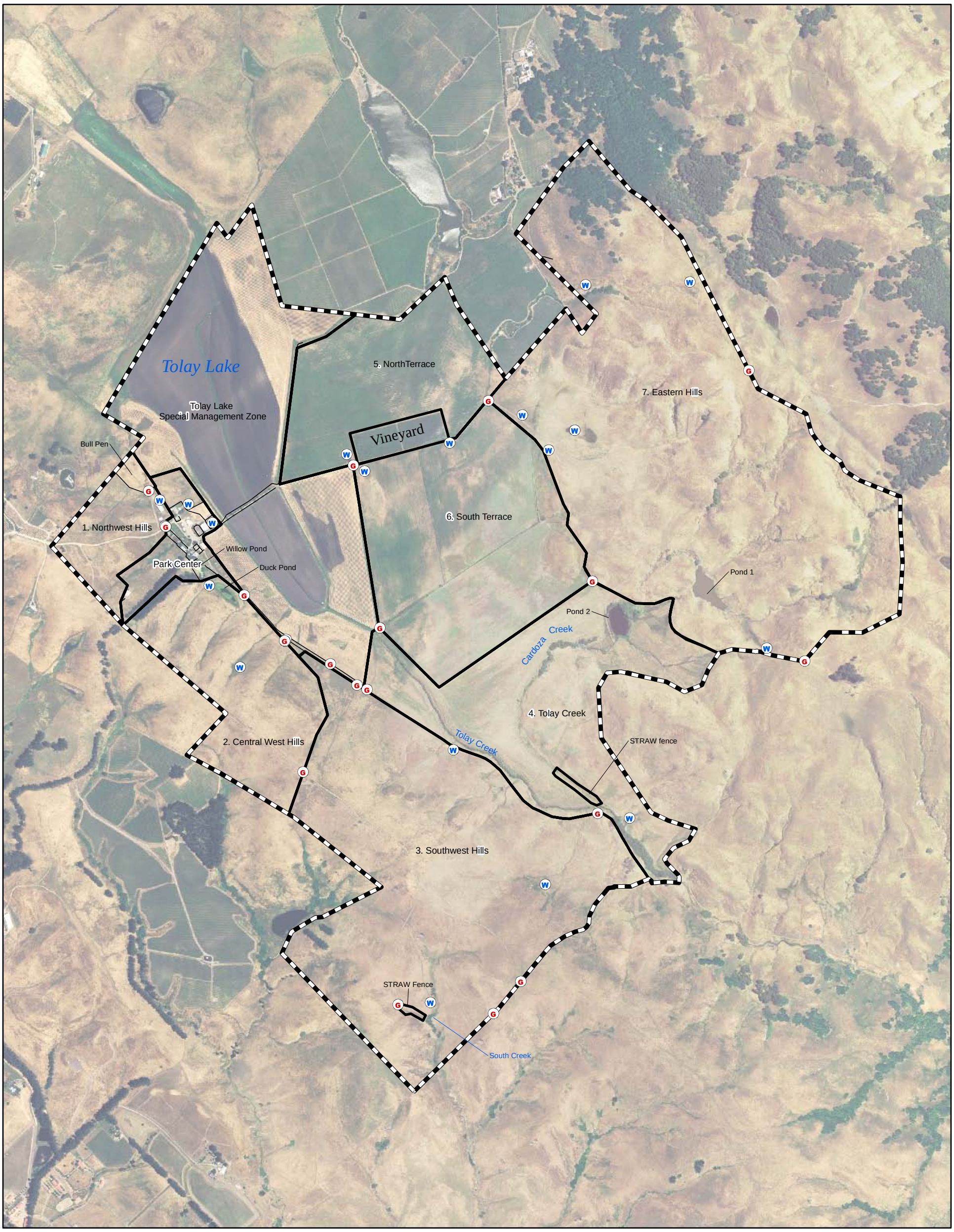
0 0.125 0.25
MILES

Rangeland Resources Study
Tolay Lake Regional Park

Sensitive Biological Resources and Interim Pasture Configurations

Source: Aerial Photo from the USDA, National Agriculture Imagery Program (2005)

I:\SOG0601\GIS\Maps\Figure6_InterimBio.mxd (01/15/2008)



LSA

FIGURE 7

Tolay Lake Regional Park Boundary

Interim Management Areas/Existing Fences

Existing Fences

Existing Gate

Existing Water Trough

Rangeland Resources Study
Tolay Lake Regional Park

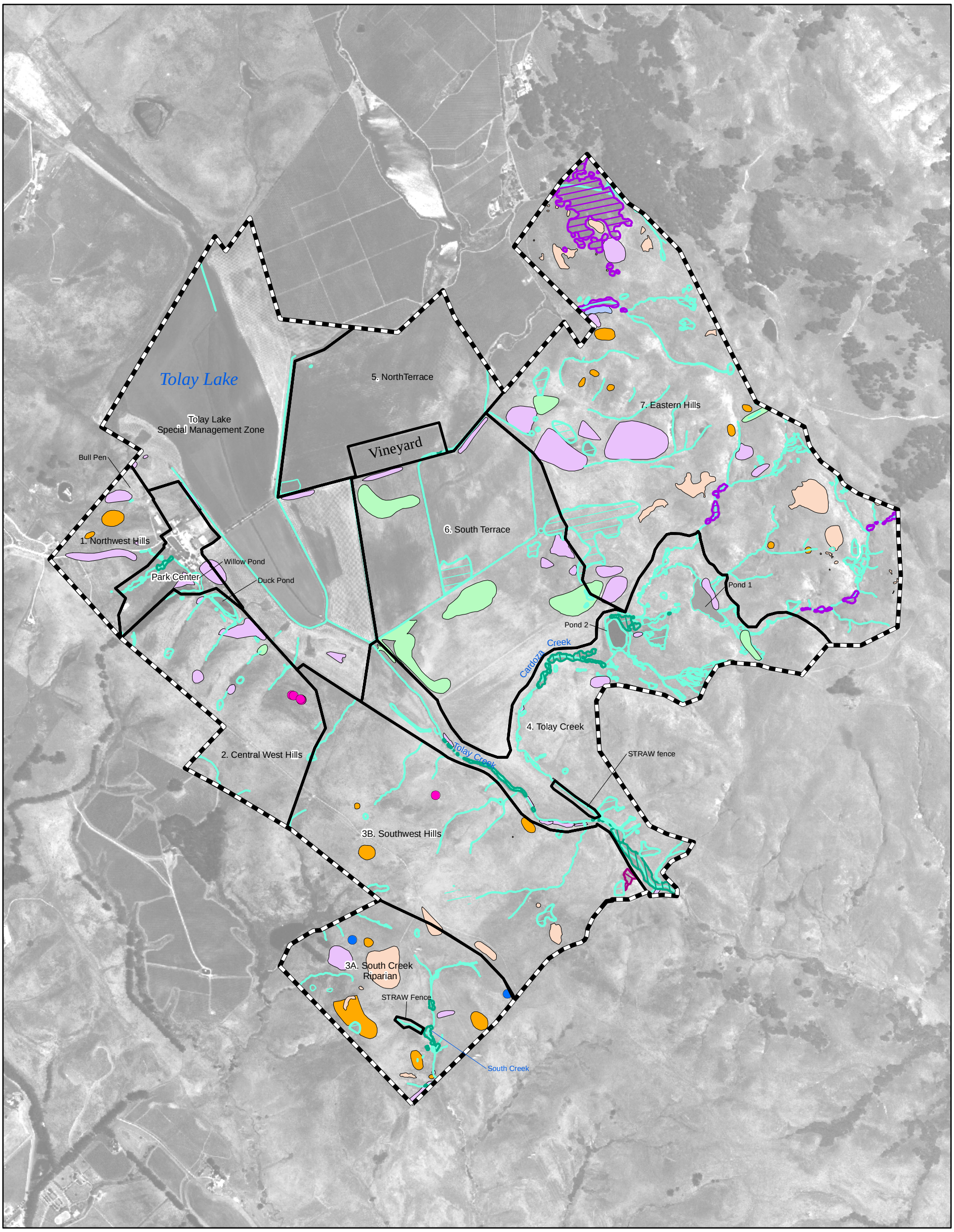
N

Interim Pasture Configurations
and Existing Range Improvements

0 0.125 0.25
MILES

Source: Aerial Photo from the USDA, National Agriculture Imagery Program (2005)

I:\SOG0601\GIS\Maps\Figure7_ExistingRangeImprovement_InterimPastures.mxd (01/03/2008)



LSA

FIGURE 8

Tolay Lake Regional Park Boundary
Long-term Management Areas
Wetland
Stream Segment/Culvert
Oak Woodland
Riparian Woodland
Buckeye Woodland

Moist Grassland (*Danthonia, Leymus, Hordeum*, etc.)
Semaphore Grass Wetland (*Pleuropogon californica*)
Johnny-Jump-up (*Viola pedunculata*) Native Wildflower Field
Purple Needlegrass Grassland (*Nassella pulchra*, etc.)
Mixed Native Wildflower Field (*Platystemon, Lithophragma*, etc)
Fragrant Fritillary (*Fritillaria liliacea*)
Lobb's Aquatic Buttercup (*Ranunculus lobbii*)

N

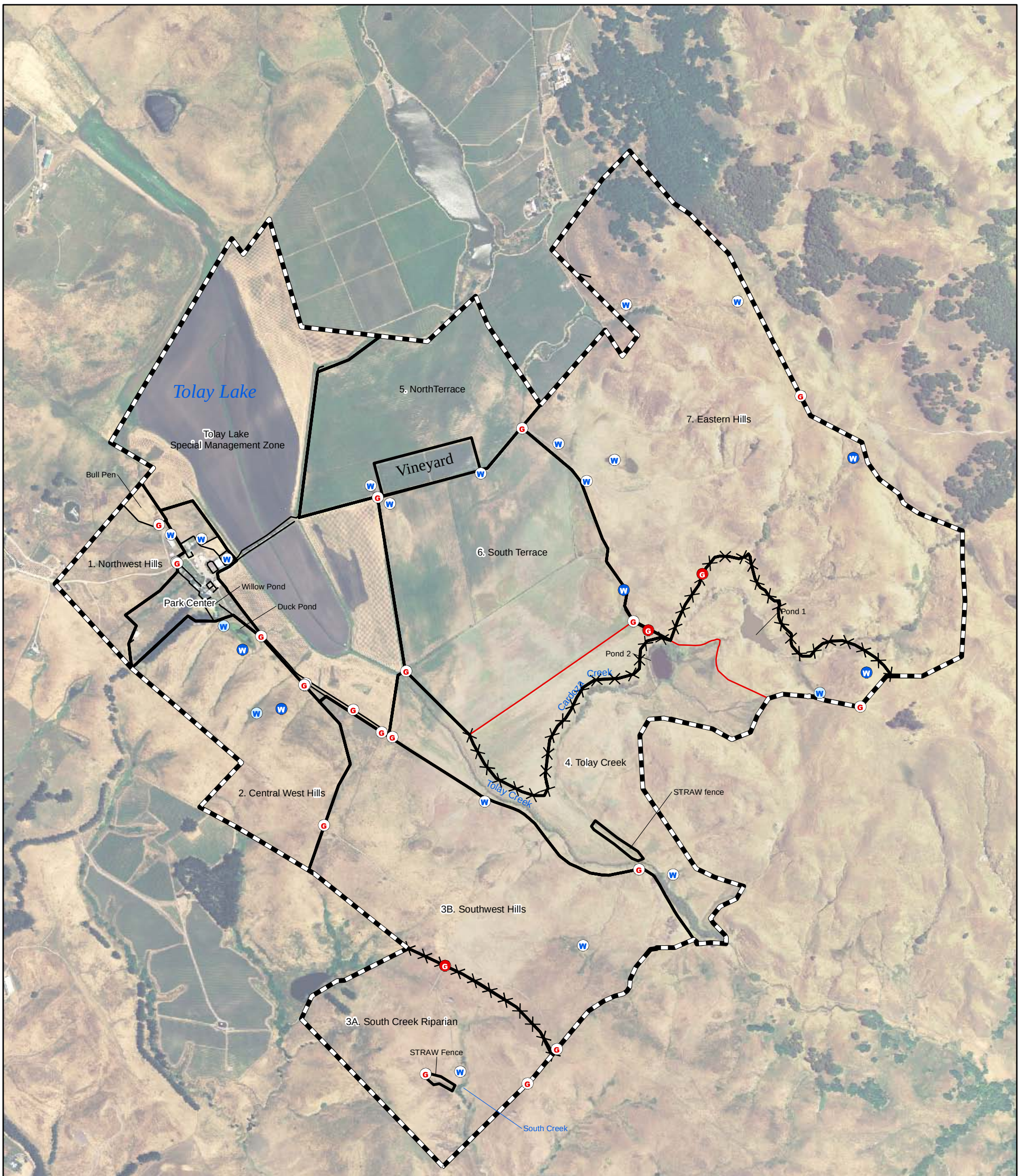
0 0.125 0.25
MILES

Rangeland Resources Study
Tolay Lake Regional Park

Sensitive Biological Resources and Long-term Pasture Configurations

Source: Aerial Photo from the USDA, National Agriculture Imagery Program (2005)

I:\SOG0601\GIS\Maps\Figure8_LongTermBio.mxd (02/1/2008)



LSA

FIGURE 9

Tolay Lake Regional Park Boundary
Long-term Management Areas
Existing Fence
Proposed Fence Removal
Proposed Fence Addition
Existing Gate
Proposed Gate
Existing Water Trough
Existing Water Trough (to be removed)
Proposed Water Trough

N

0 0.125 0.25
MILES

Rangeland Resources Study
Tolay Lake Regional Park

Long-term Pasture Configurations and Existing and Proposed Range Improvements

Source: Aerial Photo from the USDA, National Agriculture Imagery Program (2005)

I:\SOG0601\GIS\Maps\Figure9_Existing_and_Proposed_Range_Improvements.mxd (02/1/2008)

TABLES

Table A: Interim Rangeland Management Plan Summary
Table B: Grazing Carrying Capacities, Interim Pasture Configurations
Table C: Long-term Rangeland Management Plan Summary
Table D: Grazing Carrying Capacities, Long-term Pasture Configurations

Table A: Interim Rangeland Management Plan Summary, Tolay Lake Regional Park

Pasture/ Management zone	Park Center	1. North-west Hills	2. Central West Hills	3. Southwest Hills	4. Tolay Creek	5. North Terrace	6. South Terrace	7. Eastern Hills	Tolay Lake Special Mgt. Zone	Total
Sensitive resources										
Fragrant fritillary			x	x						
Native grassland	x	x	x	x	x		x	x	x	
Oak woodland								x		
Eroded soils				x	x					
Wetlands	x	x	x	x	x	x	x	x	x	
Riparian	x	x	x	x	x			x	x	
Pond shore	x				x		x	x	x	
High sensitivity cultural resource*	x			x	x		x		x	
Moderate Sen-sitivity cultural resource**	x				x		x	x	x	
Acres	31.8	41.6	108.9	341.1	184.7	107.6	187.8	484.6	264.2	1720.5
Stocking rate/ Target RDM	No live-stock use	Moderate 750 lb/ac	Light 1,250 lb/ac	Light 1,250 lb/ac	No live-stock use	Moderate 750 lb/ac	Moderate 750 lb/ac	Conservative 1,000 lb/ac	No livestock use	
Grazing season	None	Feb-May	May-Dec	May-Dec	None	June-Nov.	June-Nov.	Jan-Apr	None	
AU in average year										
January	0	21	0	0	0	0	0	84	0	105
February	0	21	0	0	0	0	0	84	0	105
March	0	21	0	0	0	0	0	84	0	105
April	0	21	0	0	0	0	0	84	0	105
May	0	0	25	72	0	0	0	0	0	97
June	0	0	25	72	0	50	45	0	0	192
July	0	0	25	72	0	50	45	0	0	192
August	0	0	25	72	0	50	45	0	0	192
September	0	0	25	72	0	50	45	0	0	192
October	0	0	25	72	0	50	45	0	0	192
November	0	0	25	72	0	50	45	0	0	192
December	0	0	25	72	0	0	0	0	0	97

Notes: * Highly sensitive cultural resource = requires exclusion fencing if the area is subject to grazing.
** Sensitive cultural resources = requires exclusion fencing or dry season grazing only.

Table B: Grazing Carrying Capacities, Interim Pasture Configurations, Tolay Lake Regional Park

Pasture	Acreage	Grazing intensity	Carrying Capacity (i.e., Animal Units) by Duration (months) in an Average Year					
			2	4	6	8	10	12
Park Center	31.8	Light	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		Conservative	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		Moderate	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		Heavy	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1 Northwest Hills	41.60	Light	31	15	10	8	6	5
		Conservative	36	18	12	9	7	6
		Moderate	41	21	14	10	8	7
		Heavy	47	23	16	12	9	8
2 Central West Hills	108.90	Light	101	51	34	25	20	17
		Conservative	119	59	40	30	24	20
		Moderate	136	68	45	34	27	23
		Heavy	154	77	51	38	31	26
3 Southwest Hills	341.10	Light	289	145	96	72	58	48
		Conservative	339	170	113	85	68	57
		Moderate	389	195	130	97	78	65
		Heavy	439	219	146	110	88	73
4 Tolay Creek	184.70	Light	163	82	54	41	33	27
		Conservative	192	96	64	48	38	32
		Moderate	220	110	73	55	44	37
		Heavy	248	124	83	62	50	41
5 North Terrace	107.60	Light	100	50	33	25	20	17
		Conservative	117	58	39	29	23	19
		Moderate	134	67	45	34	27	22
		Heavy	151	76	50	38	30	25
6 South Terrace	187.80	Light	168	84	56	42	34	28
		Conservative	196	98	65	49	39	33
		Moderate	225	113	75	56	45	38
		Heavy	254	127	85	64	51	42
7 Eastern Hills	484.60	Light	109	55	36	27	22	18
		Conservative	168	84	56	42	34	28
		Moderate	226	113	75	57	45	38
		Heavy	284	142	95	71	57	47

Pasture	Acreage	Grazing intensity	Carrying Capacity (i.e., Animal Units) by Duration (months) in an Average Year					
			2	4	6	8	10	12
Tolay Lake Special Management Zone	n.a.	Light	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		Conservative	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		Moderate	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		Heavy	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total	1488.10	Light	961	481	320	240	192	160
		Conservative	1167	583	389	292	233	194
		Moderate	1372	686	457	343	274	229
		Heavy	1577	789	526	394	315	263

Table C: Long-term Rangeland Management Plan Summary, Tolay Lake Regional Park

Pasture/ Management zone	Head-quarters	1. North-west Hills	2. Central West Hills	New 3A. South Creek Riparian	New 3B. Southwest Hills	New 4. Tolay Creek	5. North Terrace	New 6. South Terrace	New 7. Eastern Hills	Tolay Lake Special Mgt. Zone	Total
Sensitive resources											
Fragrant fritillary			x	x	x						
Native grassland	x	x	x	x	x	x		x	x	x	
Oak woodland									x		
Eroded soils				x	x	x					
Wetlands	x	x	x	x	x	x	x	x	x	x	
Riparian	x	x	x	x	x	x			x	x	
Pond shore	x					x		x	x	x	
High sensitivity cultural resource*	x			x	x	x		x		x	
Moderate sensitivity cultural resource**	x					x		x	x	x	
Acres	31.8	41.6	108.9	114.9	225.6	204.4	107.6	216.2	426.5	264.4	1710.1
Stocking rate/ Target RDM	No live-stock use	Moderate 750 lb/ac	Light 1,250 lb/ac	Light 1,250 lb/ac	Moderate 750 lb/ac	Light 1250lb/ac	Moderate 750 lb/ac	Moderate 750 lb/ac	Conservative 1,000 lb/ac	Conservative 1,000 lb/ac	
	None	Dec-Mar	May-Dec	Mar-June	Dec-Feb, Jul-Sept	Mar-June	April-Nov.	April-Nov.	Oct.-Mar	Pulsed	
AU in average year											
January	0	21	0	0	88	0	0	0	54	0	163
February	0	21	0	0	88	0	0	0	54	0	163
March	0	21	0	69	0	98	0	0	54	0	242
April	0	0	0	69	0	98	0	0	0	0	167
May	0	0	25	69	0	98	0	0	0	0	192
June	0	0	25	0	0	0	45	87	0	0	157
July	0	0	25	0	88	0	45	87	0	0	245
August	0	0	25	0	88	0	45	87	0	0	245
September	0	0	25	0	88	0	45	87	0	0	245
October	0	0	25	0	0	0	45	87	54	0	211
November	0	0	25	0	0	0	45	87	54	0	211
December	0	21	25	0	88	0	0	0	54	0	188

Notes: * Highly sensitive cultural resource = requires exclusion fencing if the area is subject to grazing. Exclusion deducted from acreage.

** Sensitive cultural resources = requires dry season grazing only.

Table D: Grazing Carrying Capacities, Proposed Pasture Configurations, Tolay Lake Regional Park

Pasture	Acreage	Grazing intensity	Carrying Capacity (i.e., Animal Units) by Duration (months) in an Average Year					
			2	4	6	8	10	12
Park Center	31.8	Light	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		Conservative	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		Moderate	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		Heavy	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1 Northwest Hills	41.60	Light	31	15	10	8	6	5
		Conservative	36	18	12	9	7	6
		Moderate	41	21	14	10	8	7
		Heavy	47	23	16	12	9	8
2 Central West Hills	108.90	Light	101	51	34	25	20	17
		Conservative	119	59	40	30	24	20
		Moderate	136	68	45	34	27	23
		Heavy	154	77	51	38	31	26
3 Southwest Hills	225.60	Light	197	99	66	49	39	33
		Conservative	231	116	77	58	46	39
		Moderate	265	133	88	66	53	44
		Heavy	299	150	100	75	60	50
3a South Creek Riparian	114.9	Light	91	46	30	23	18	15
		Conservative	107	54	36	27	21	18
		Moderate	123	61	41	31	25	20
		Heavy	139	69	46	35	28	23
4 Tolay Creek	204.40	Light	131	65	44	33	26	22
		Conservative	153	77	51	38	31	26
		Moderate	176	88	59	44	35	29
		Heavy	199	99	66	50	40	33
5 North Terrace	107.60	Light	100	50	33	25	20	17
		Conservative	117	58	39	29	23	19
		Moderate	134	67	45	34	27	22
		Heavy	151	76	50	38	30	25
6 South Terrace	216.20	Light	194	97	65	49	39	32
		Conservative	228	114	76	57	46	38
		Moderate	262	131	87	65	52	44
		Heavy	295	148	98	74	59	49

Pasture	Acreage	Grazing intensity	Carrying Capacity (i.e., Animal Units) by Duration (months) in an Average Year					
			2	4	6	8	10	12
7 Eastern Hills	426.50	Light	104	52	35	26	21	17
		Conservative	161	80	54	40	32	27
		Moderate	217	108	72	54	43	36
		Heavy	273	137	91	68	55	46
Tolay Lake Special Management Zone	264.40	Light	245	122	82	61	49	41
		Conservative	287	144	96	72	57	48
		Moderate	330	165	110	82	66	55
		Heavy	372	186	124	93	74	62
Total	1741.60	Light	1195	597	398	299	239	199
		Conservative	1439	720	480	360	288	240
		Moderate	1684	842	561	421	337	281
		Heavy	1928	964	643	482	386	321

APPENDIX A

DEFINITIONS OF RANGE MANAGEMENT TERMS

APPENDIX A

DEFINITIONS OF RANGE MANAGEMENT TERMS FOR THE TOLAY LAKE REGIONAL PARK RANGELAND RESOURCES STUDY

TERM	DEFINITION
Air-dry weight	The weight of a substance (usually forage) after it has been allowed to dry to equilibrium with the atmosphere.
Animal-unit (AU)/ Animal Unit Equivalent (AUE)	Defines forage consumption on the basis of one standard mature 1,000-pound cow, either dry or with calf up to 6 months old; all other classes and kinds of animals can be related to this standard as animal unit equivalents (AUE), e.g., a bull equals 1.25 AU, a yearling steer or heifer equals 0.75 AU.
Animal-unit-month (AUM)	The amount (780 pounds) of air-dry forage calculated to meet one animal unit's requirement for one month.
Carrying capacity	The average number of livestock and wildlife that may be sustained on a management unit compatibly with management objectives. It is a function of site characteristics, and management goals and intensity.
Class of animal	Description of age and sex group for a particular kind of animal, e.g., cow, calf, yearling heifer, ewe, fawn.
Cover	(1) The plant or plant parts, living or dead, on the ground surface. (2) The proportional area of ground covered by plants on a stated area.
Forage	Browse and herbage that are available for food for grazing animals or to be harvested for feeding.
Forage production	The weight of forage that is produced within a designated period of time on a given area (e.g., pounds per acre).
Forb	A non-woody, broad-leafed plant.
Grass	A plant with long, narrow leaves having parallel veins and nondescript flowers. Stems are hollow or pithy in cross-section.
Grazing distribution	Dispersion of livestock grazing within a management unit.
Grazing management	The control of grazing and browsing animals to accomplish a desired result.
Grazing pressure	An animal-to-forage relationship measured in terms of animal units per unit weight of forage at any instant.

TERM	DEFINITION
Key area	A relatively small potion of a management unit selected because of its location, use, or grazing value as a monitoring point for grazing use. It is assumed key areas will reflect the overall acceptability of current grazing management over the whole unit.
Kind of animal	An animal species or species group such as sheep, cattle, goats, deer, horses, elk, antelope.
Monitoring	The orderly collection, analysis, and interpretation of resource data over time to evaluate progress toward meeting management objectives.
Native species	A species that is a part of the original fauna or flora of a given area.
Overgrazing	Continued heavy grazing that exceeds the recovery capacity of individual plants in the community and creates a deteriorated range.
Overstocking	Placing a number of animals on a given area that exceeds the forage supply during the time they are present.
Overuse	Using an excessive amount of the current year's growth.
Palatability	The relish with which a particular species or plant part is consumed by an animal.
Pasture	A grazing area enclosed and separated from other areas by fencing or other barriers.
Photopoint	A point from which photos are periodically taken to monitor long-term management responses.
Plant community	An assemblage of plants occurring together at any point in time, denoting no particular ecological status.
Range (Rangeland)	Any land supporting grazable or browsable vegetation and managed as a natural ecosystem; can include grasslands, forestlands, shrublands, and pasture. "Range" is not a land use.
Range improvement	Any practice designed to improve range condition or allow more efficient use.
Range management	A distinct discipline founded on ecological principles with the objective of sustainable use of rangelands and related resources for various purposes.

TERM	DEFINITION
Range site	Land with a specific potential natural community and specific physical site characteristics, differing from other kinds of land in its ability to produce vegetation and to respond to management. Synonymous with range site.
Residual dry matter (RDM)	Residual dry matter is the old plant material left standing or on the ground at the beginning of a new growing season (typically early fall immediately prior to the first rains).
Rest	Leaving an area ungrazed for a specified time.
Stocking rate	The number of specific kinds and classes of animals grazing a unit of land for a specified time period.
Use	The proportion of current years forage production that is consumed or destroyed by grazing animals.
Weed	(1) A plant growing where unwanted. (2) A plant having a negative value within a given management system.

Reference:
Ortmann, J., L.R. Roath and E.T. Bartlett. 2000. Glossary of range management terms no. 6.105. Colorado State University Cooperative Extension. 5pp.

APPENDIX B

RANGE ANALYSIS (INTERIM PASTURES)

Appendix B - Range Analysis: Interim Pastures
Tolay Lake Special Management Zone

Moderate Use

Target RDM (lb/acre)	750
Dry-Matter (lb) per AUM	780

Soil Type	Soil Symbol	Acres	Dry-weight Production (lb/acre)			Available Forage (AUM/acre)			Total Available Forage (AUM)		
			Favorable	Average	Unfavorable	Favorable	Average	Unfavorable	Favorable	Average	Unfavorable
Clear Lake clay loam, 0-2% slopes	*CcA*	0.0	3,600	2,700	1,800	3.7	2.5	1.3	0.0	0.0	0.0
Diablo clay, 2-9% slopes	*DbC*	0.0	3,600	2,700	1,800	3.7	2.5	1.3	0.0	0.0	0.0
Diablo clay, 9-15% slopes	*DbD*	0.0	3,600	2,700	1,800	3.7	2.5	1.3	0.0	0.0	0.0
Diablo clay, 15-30% slopes	*DbE*	0.0	3,600	2,700	1,800	3.7	2.5	1.3	0.0	0.0	0.0
Diablo clay, 30-50% slopes, eroded	*DbF2*	0.0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Goulding Cobbly Clay Loam, 5-15% slopes	*GlD*	0.0	3,600	2,700	1,800	3.7	2.5	1.3	0.0	0.0	0.0
Goulding-Toomes complex, 9-50% slopes	*GoF*	0.0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Gullied Land	*GuF*	0.0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Haire clay loam, 9-15% slopes	*HcD*	0.0	2,800	2,200	1,600	2.6	1.9	1.1	0.0	0.0	0.0
Laniger loam, 5-9% slopes	*LaC*	0.0	2,400	1,800	1,200	2.1	1.3	0.6	0.0	0.0	0.0
Laniger loam, 9-15% slopes	*LaD*	0.0	2,400	1,800	1,200	2.1	1.3	0.6	0.0	0.0	0.0
Laniger loam, 15-30% slopes, eroded	*LaE2*	0.0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Water	*W*	0.0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total		**0.0**							**0.0**	**0.0**	**0.0**

APPENDIX C

RANGE ANALYSIS (PROPOSED PASTURES)

Appendix C - Range Analysis: Proposed Pastures
Tolay Lake Special Management Zone

Heavy Use

Target RDM (lb/acre)	500
Dry-Matter (lb) per AUM	780

Soil Type	Soil Symbol	Acres	Dry-weight Production (lb/acre)			Available Forage (AUM/acre)			Total Available Forage (AUM)		
			Favorable	Average	Unfavorable	Favorable	Average	Unfavorable	Favorable	Average	Unfavorable
Clear Lake clay loam, 0-2% slopes	*CcA*	248.1	3,600	2,700	1,800	4.0	2.8	1.7	985.9	699.7	413.5
Diablo clay, 2-9% slopes	*DbC*	2.9	3,600	2,700	1,800	4.0	2.8	1.7	11.7	8.3	4.9
Diablo clay, 9-15% slopes	*DbD*	10.5	3,600	2,700	1,800	4.0	2.8	1.7	41.7	29.6	17.5
Diablo clay, 15-30% slopes	*DbE*		3,600	2,700	1,800	4.0	2.8	1.7	0.0	0.0	0.0
Diablo clay, 30-50% slopes, eroded	*DbF2*		0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Goulding Cobbly Clay Loam, 5-15% slopes	*GlD*		3,600	2,700	1,800	4.0	2.8	1.7	0.0	0.0	0.0
Goulding-Toomes complex, 9-50% slopes	*GoF*		0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Gullied Land	*GuF*		0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Haire clay loam, 9-15% slopes	*HcD*	2.9	2,800	2,200	1,600	2.9	2.2	1.4	8.4	6.2	4.0
Laniger loam, 5-9% slopes	*LaC*		2,400	1,800	1,200	2.4	1.7	0.9	0.0	0.0	0.0
Laniger loam, 9-15% slopes	*LaD*		2,400	1,800	1,200	2.4	1.7	0.9	0.0	0.0	0.0
Laniger loam, 15-30% slopes, eroded	*LaE2*		0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Water	*W*		0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total		**264.4**							**1047.7**	**743.8**	**439.9**