


Sonoma Developmental Center

EXISTING CONDITIONS REPORT:
Natural and Recreational Resources

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1 Introduction

The Sonoma Developmental Center site's 945 acres support a wealth of precious biological resources. Diverse terrain, perennial water sources, a history of limited, focused development, and regional connectivity all contribute to the site's unique ecological and human values. Redwood and fir forests, oak woodlands, riparian corridors, wetlands and grasslands provide crucial wildlife habitat, watershed protection, scenic values, and recreational opportunities in a region where these are both highly valued by the local community and at risk of loss.

As part of the State Department of General Service's efforts to plan for the closure of the Developmental Center and to consider future uses of the site, Prunuske Chatham, Inc. (PCI) led the WRT team's assessment of ecological and recreational resources. The goal of the assessment was to describe key resources to the extent needed for conceptual site planning, highlighting areas of concern relative to potential future uses, and identifying opportunities for protection and enhancement.

This report describes the site's ecological and recreational resources, how these resources relate to human needs and values, and how they have been shaped by human uses. The report also outlines potential strategies for protecting or enhancing those resources, for consideration as the state and the community at large plan for the future of the site.

2 Methods

PCI previously completed a general resource assessment for the site on behalf of the Sonoma County Agricultural Preservation and Open Space District (SCAPOSD) and other local partners (PCI 2015). That assessment was broader than PCI's current task, encompassing physical, cultural, and infrastructure resources as well as ecological resources, but did not include detailed on-site surveys. However, it provided a valuable starting point for this current effort.

For this current assessment, PCI began by reviewing existing data and updates to information since the 2015 effort. Sources consulted include:

- Aerial photographs of the property
- Soil survey of Sonoma County (USDA 1972, NRCS 2017)
- Sonoma County Vegetation and Habitat Mapping Program mapping (SCAPOSD, 2017) and classifications (Klein et al. 2015)
- California Department of Fish and Wildlife Natural Diversity Database[1] (CNDDB; CDFW 2017a)
- U.S. Fish and Wildlife Service, Information for Planning and Consultation (USFWS 2017)

[1] The California Natural Diversity Data Base (CNDDB) is a repository of information on sightings and collections of rare, threatened, or endangered plant and animal species within California. It is maintained by the California Department of Fish and Wildlife (CDFW). CNDDB reports occurrences of special-status species that have been entered into the database and does not generally include inventories of more common animals or plants. The absence of a species from the database does not necessarily mean that it does not occur in the area, only that no sightings have been reported. In addition, sightings are subject to observer judgment and may not be entirely reliable as a result.

- CNPS Inventory of Rare and Endangered Vascular Plants of California On-line Inventory (CNPS 2017)
- Calflora database (Calflora 2017), including Consortium of California Herbaria records
- Oak Mapper (2017) – records of Sudden Oak Death observations
- Field guides and general references for fish, birds, mammals, reptiles, and amphibians
- Local surveys and references for Sonoma County birds (Burridge 1995; Bolander and Parmeter 2000).
- Review of Water Resources for Sonoma Developmental Center (Sonoma County Water Agency 2015)
- Sonoma Valley Historical Hydrology Mapping Project, Phase 1 (Dawson et al. 2016)
- Watershed Sanitary Survey – Roulette Springs, Asbury Creek, Hill Creek, and Sonoma Creek (Barber et al. 2012)

Many additional resources were consulted and are referenced within the text.

PCI also participated in stakeholder interviews and consulted local and regional experts in natural and open space resources for further information. These included interviews and email exchanges with:

- Quinton Martins and Jeanne Wirka - Audubon Canyon Ranch
- Richard Dale and Caitlin Cornwall - Sonoma Ecology Center
- Tony Nelson, Wendy Eliot, John McCaull - Sonoma Land Trust, and Stephanie Duncan Karp - Portrero Group
- Bill Keene and Misti Arias - Sonoma County Agricultural Preservation and Open Space District
- Arthur Dawson, Meg Beeler, and Nancy Kirwan - Sonoma Mountain Preservation
- Chuck Levine, Karen Collins, Mary McEachern, and Tjiska van Wyk - Jack London Park Partners
- Ken Tam - Sonoma County Regional Parks
- Diana Rhoten - Challenge Sonoma Adventure Ropes Course

Field surveys of the site included assessments of:

- General plant and wildlife habitat conditions, refining existing Sonoma Veg Map data, noting areas of special value or concern, and assessing potential for special-status species presence.
- Wildlife corridor conditions, focusing on road crossings, habitat qualities in key locations, and other potential constraints such as fencing.
- Salmonid and freshwater shrimp habitat conditions, walking Sonoma Creek and Asbury and Hill Creeks where these were accessible and within the project site, and including fish passage barrier assessment.
- Wetland conditions, focusing on the large eastern wetland.
- Open space and recreational facilities and conditions, including general trail conditions, access points, and a brief overview of other existing facilities.

Surveys were conducted in June and July 2017 over a total of approximately 13 person-days. Surveys were carried out by PCI's principal vegetation ecologist, senior wildlife biologist, principal geomorphologist, hydrologist, and senior landscape architect. Points of interest were recorded either with a Trimble XH hand-held global positioning system unit or drawn by hand on large-format field maps with aerial imagery and contours, and then digitally mapped in the office. SDC staff provided valuable background information about site conditions and the water system during these visits.

Wildfire burned the eastern portion of the property, and dramatically altered adjacent communities, in

the Nuns Fire of October 2017, after the bulk of this report was prepared. PCI briefly toured the site in November to review post-fire conditions; short notes about observations are included in the Plant Communities section of this report.

3 Setting

Figure 1. Sonoma Developmental Center regional context.

The Sonoma Developmental Center (SDC) is located within the inner North Coast Range, in the northern San Francisco Bay Area. The site extends from the eastern slope of Sonoma Mountain onto the adjacent flats of the northern Sonoma Valley.

Regional Context

Sonoma Mountain is a prominent landscape feature in the North Bay Area, extending approximately 20 miles from the Bay to Santa Rosa. The Sonoma Valley lies between Sonoma Mountain to the west and the Mayacamas Mountains to the east, extending from Santa Rosa in the northwest to San Pablo Bay at its southern end. The Mayacamas Mountains on the eastern edge of the valley, across from SDC, form the boundary between Sonoma and Napa Counties. This range extends from southern Mendocino County southeast for approximately 50 miles to southern Sonoma County.

Land uses in the Sonoma Valley include agriculture, suburban and urban development, and parks and open space. Sonoma Valley is considered the birthplace of the California wine industry; today, nearly one million people visit each year. Highway 12 and Arnold Drive are the major thoroughfares through the valley and are designated scenic corridors.

SDC is part of the Sonoma Creek watershed, which encompasses 170 square miles. The creek flows for 31

miles from the north end of Sonoma Valley near Pythian Road, collecting water from the streams and ridgetops to the east and west, and drains to the south into San Pablo Bay. Its major tributaries include Calabazas, Stuart, Graham, Asbury, and Bear Creeks. Sonoma Creek bisects SDC and Asbury Creek forms its northern boundary. The smaller Hill Creek runs along SDC's southern boundary and drains the southern portion of the property. Butler Canyon Creek flows across the southeastern corner of SDC and flows south into Wilson Creek, which joins Sonoma Creek south of SDC.

SDC supports oak woodlands, mixed evergreen forests, riparian woodlands, grasslands, and wetlands. Many of these habitats are contiguous with natural habitats of Sonoma Mountain and Sonoma Valley beyond SDC's boundaries. SDC's forests form part of an extensive swath of habitat along the length of Sonoma Mountain, and a narrow band of riparian woodland follows Sonoma Creek upstream and downstream of the site. However, vineyard and residential development has shaped the landscape surrounding SDC, resulting in some fragmentation and loss of habitat. Portions of the remaining habitat on these adjacent lands are protected from further development, but many are not.

Because of its intact habitat, its terrain, and its connectivity, SDC has a key position in a corridor considered critical for wildlife. The Sonoma Valley Wildlife Corridor (Corridor) is considered by local and regional conservation agencies to be a crucial part of a network of linkages connecting large undeveloped landscape blocks in Marin County to those in the Blue Ridge Mountains/Lake Berryessa area in eastern Napa County (Penrod et al., 2013; SLT, 2014). The Sonoma Valley Wildlife Corridor encompasses approximately 10,000 acres and stretches from the top of Sonoma Mountain across Sonoma Creek and the valley floor to the Mayacamas Mountains to the east (Exhibit 1a). This corridor is considered a vital connection for wildlife movement through the Bay Area. Recent work on mountain lions shows that north-south movement, along the flanks of Sonoma Mountain and the other local mountain ranges, is also of key importance (Q. Martins, pers. comm.).

Adjacent Ownership and Land Uses

SDC is a central link in a swath of over 8,000 acres of protected open space and parkland that has been assembled over the past few decades (Exhibit 1a,b). (Additional nearby lands have been protected for intensive agricultural uses, including vineyards, but these generally have lower natural resource values.) SDC represents the largest and most ecologically significant unprotected property in the Sonoma Valley.

Lands adjacent to SDC include both publicly and privately owned parcels. The town of Eldridge lies immediately south of the central campus. Rural residential parcels, mostly ranging from 4 to 10 acres in size, are present north and south of SDC's west side. Native woodlands and forests are still present to some degree on many of these lands. Vineyards occupy much of the land south of the east side of the site, and are also present north and south of SDC's western slopes. Parklands abut SDC's western edge, and its northeastern boundary.

Jack London State Historic Park (Jack London SHP) is adjacent to SDC to the west, and surrounds Camp Via. The park was established in 1959 on the ranch of acclaimed author Jack London. It encompasses approximately 1,500 acres, reaches nearly to the top of Sonoma Mountain, and contains the headwaters of Asbury and Hill Creeks, which both run through SDC, as well as the headwaters of Graham Creek. Jack London SHP includes 26 miles of trails, a museum, historic buildings, historic ranch facilities, and the grave site of Jack London. It supports a range of native plant communities, from grassy meadows and oak woodlands to dense forests of Douglas-fir. The park is also known to support special-status northern

spotted owl.

The Shepard ranch is adjacent to SDC's northwestern tip. This is a 178-acre remnant of Jack London's ranch, which was not sold to the State in 1979, but is now encompassed by Jack London SHP and protected by a conservation easement held by the State. The property has been converted to vineyard and is currently owned by London relatives Brian Shepard and Neil Shepard (McConahey 2016). Brian Shepard, and Shepard's cousin, Steve Shaffer, oversee the Jack London vineyards for a family trust. They raise cabernet sauvignon, merlot, zinfandel and syrah grapes which are sold to Kenwood Vineyards. Neil Shepard also operates a Clydesdale horse business from the property.

Sonoma Valley Regional Park (SVRP) is adjacent to SDC's northeastern border and is owned and operated by Regional Parks. This 162-acre park has a paved trail running the length of the park, east-west between Highway 12 and Arnold Drive. Several unpaved trails lead from this main trail onto the SDC property. The park supports extensive oak woodland habitat. The one-acre Elizabeth Anne Perrone Dog Park is located near the entrance, adjacent to Highway 12. In 2007, a 41-acre parcel (located at 14400 Sonoma Highway) was purchased by SCAPOSD and then conveyed to the County and added to SVRP. SCAPOSD retains a conservation easement over the parcel to preserve its open space, and natural and scenic values. The 29-acre Curreri parcel, along the park's northern border, was recently purchased by Sonoma Land Trust and SCAPOSD. This property is protected with a SCAPOSD conservation easement and has been incorporated into SVRP. A master plan and resource management plan for these park additions was recently completed; it calls for new trails, including some that connect to SDC, and an array of resource protection measures (Sonoma County Regional Parks 2017).

Regional Parks also owns the 23-acre parcel Bouverie Wildflower Preserve immediately east of SDC and SVRP, on the east side of Highway 12, on the southern border of Audubon Canyon Ranch's Bouverie Preserve. David Bouverie donated the property to Regional Parks to provide wildflower viewing. Deed restrictions prevent trail development on the property.

Bouverie Preserve is a 535-acre preserve of the Audubon Canyon Ranch. It lies to the north of SDC, on the east side of Highway 12, immediately across from SVRP. Audubon Canyon Ranch is a non-profit environmental conservation and education organization. Bouverie Preserve hosts on-site education programs for elementary school students and the public, and conducts conservation science and habitat restoration programs focusing on grasslands, vernal pools, wildflower fields, mountain lions, and amphibians.

Sonoma Land Trust owns a number of lands in the vicinity of SDC. Glen Oaks Ranch (234 acres) lies directly north of Bouverie Preserve, and Secret Pasture (300 acres) borders the Bouverie Preserve's southeast side. These properties protect important wildlife habitats, valley oak habitat, and historic structures. Stuart Creek Hill (14 acres) and several others nearby, smaller parcels along Stuart Creek are just north of SVRP and were protected for their value as steelhead habitat and wildlife corridors.

SLT also holds conservation easements on Oak Hill Farm (677 acres) and Old Hill Ranch (37 acres). Old Hill Ranch is adjacent to SDC to the south and Oak Hill Farm is adjacent to SDC to the east, across Highway 12. These easements are intended to protect agricultural uses of the lands as well as riparian habitat and other wildlands. The lands are owned by Anne Teller. Oak Hill Farm produces flowers and produce. Old Hill Ranch is a historic dry-farmed zinfandel vineyard founded by Anne Teller's children, Arden, Kate, Ted and Will Bucklin. Both the farm and ranch have a focus on sustainable practices.

SCAPOSD maintains conservation easements on multiple privately owned properties in SDC'S vicinity on Sonoma Mountain. These include the McCrea (282 acres), Frieberg (203 acres), and the Eliot and Lupine Hill (71 acres) parcels immediately south of Jack London SHP. These properties are protected for their viewsheds, wildlife corridors, and other conservation values.

The 820-acre North Sonoma Mountain Regional Park and Open Space Preserve, owned by Regional Parks, was purchased and protected by SCAPOSD. These lands are adjacent to Jack London SHP's western border and Fairfield Osborne Preserve. The property provides hiking trails that connect SDC to the 550-mile Bay Area Ridge Trail. SCAPOSD-held conservation easement protects the scenic, natural, recreational, educational, and agricultural resources of the property.

Just west of Jack London SHP, on the summit and western slope of Sonoma Mountain, the private non-profit Sonoma Mountain Ranch Preservation Foundation owns and operates a 613-acre ranch. The Foundation is dedicated to preserving "the natural beauty and biodiversity of the Sonoma Mountain area, and providing education and guidance, through research, for the preservation and enhancement of agricultural, natural, scenic, and open lands (Sonoma Mountain Ranch 2017)." The Foundation's work includes research into sustainable grazing and rangeland management practices, including the use of prescribed fire and intensively managed cattle grazing.

4 Hydrology and Geomorphology

Sonoma Developmental Center sits within the central portion of the Sonoma Valley and the approximately 170 square mile Sonoma Creek watershed (Figure 2). Sonoma Creek bisects the property. Through SDC, Sonoma Creek is perennial, having drained approximately 50 square miles and fed by the numerous springs and seeps that characterize the upper Sonoma Valley. Two perennial tributaries, Asbury and Hill Creeks, flow from the western ridge of Sonoma Mountain along the northern and southern property boundaries and into Sonoma Creek. Multiple intermittent tributaries are located on the west side of the property and feed Asbury, Hill, and Sonoma Creeks. Several seasonal creeks originate on and flow from the eastern side of SDC, including Butler Canyon Creek, which passes across the southeastern corner of SDC and into Wilson Creek south of SDC. Two of the intermittent creeks have been dammed to create Fern Lake (west side of property) and Suttonfield Lake (east side of property). Springs and seeps are abundant along the western ridge near the property boundary, and may be associated with the contact between Quaternary landslide deposits and the fractured Sonoma Volcanics geologic formation. Upland perennial wetlands, such as Roulette Springs, are found where these springs surface. A large seasonal wetland is found along one of the unnamed intermittent tributaries on the eastern side of the property.

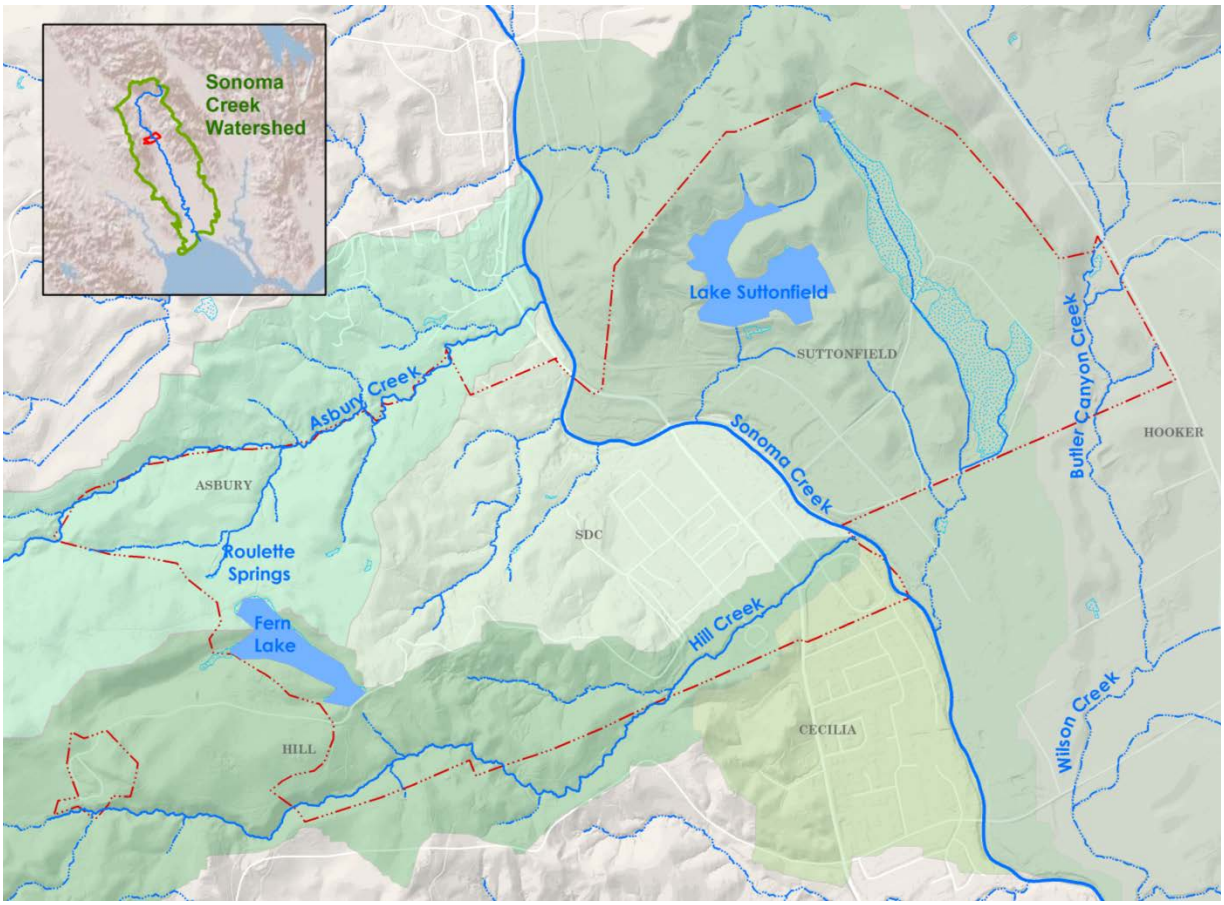


Figure 2. Creeks, intermittent drainages, springs, and wetlands within SDC. Tributary watersheds are shown in shades of green. Map is based on 2013 Sonoma County LiDAR.

Accounts of Sonoma Valley from the early and mid-1800s describe a very different landscape than what is present today. Sonoma Creek appears to have had "no set watercourse upon leaving Adobe Canyon" (just north of Kenwood) (Barber et al. 2012). Instead, the valley was covered with interconnected marshes, ponds, vernal pools, and networks of small channels (Barber et al., 2012; San Francisco Estuary Institute, 2008, Dawson et al. 2016). It is estimated that perennial wetlands covered about 1% of the valley floor and seasonal wetlands covered 20% or more. The largest perennially wetted feature in the Sonoma Valley was a large wetland complex that encompassed much of what is now Kenwood. Many tributary channels were disconnected from Sonoma Creek; they flowed directly into the wetlands on the valley floor, while others flowed across alluvial fans and shifted their course frequently (Dawson et al. 2016). Figure 3 shows what is known about historic channels and wetland features within the main campus area of SDC. Because the pre-European settlement channels were so connected to their floodplains and to the extensive wetland network on the valley floor, the hydrology was likely very different than what is seen today. The channels were not incised, they were less flashy (i.e., less responsive to rain events), and the rate of sediment delivery to the mainstem Sonoma Creek was much lower.

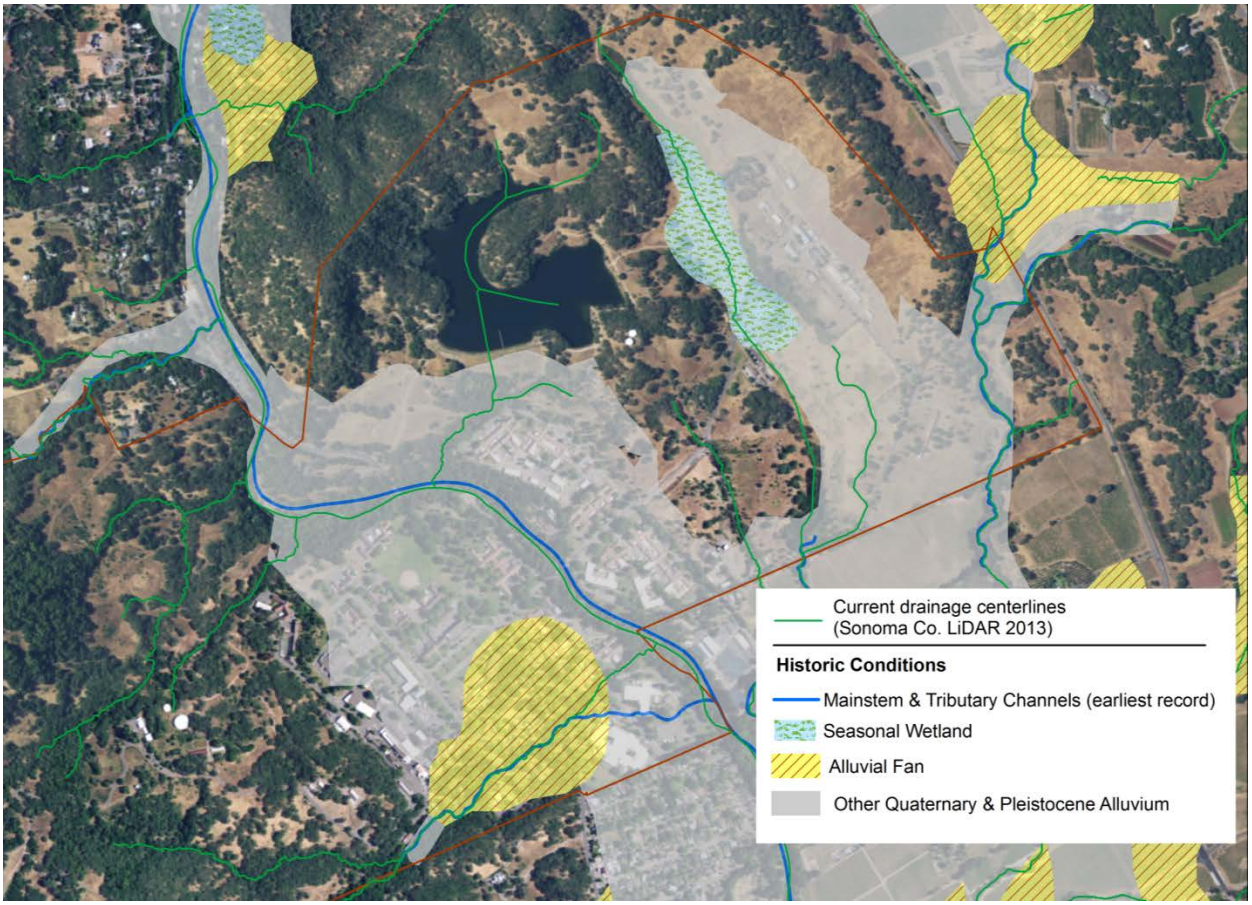


Figure 3. Historical hydrology from Dawson et al. (2016), with current drainages for reference. Note apparently altered (shortened) course of Hill Creek at confluence with Sonoma Creek. Other historic channels and wetlands appear similar to current conditions at SDC.

To make way for agricultural land uses, early European settlers quickly drained the wetlands, cleared the vegetation, and channelized the creeks to get the water off the valley floor and reduce flooding (Barber et al. 2012). These hydromodifications set in motion a cascade of changes to the stream network, creek morphology, streamflow patterns, water table levels, groundwater recharge, and associated habitat conditions. The off-channel, low-velocity habitats needed for successful rearing of salmonids and flourishing of other native aquatic species are now largely missing from the channel network. Today Sonoma Creek and its tributaries are deeply incised into the valley's alluvial fill. The creeks are constrained within their narrow channels; they have no connection to their historical floodplains and the associated riparian corridors are a small fraction of their historic widths. Flows are flashier, and opportunities for infiltration and groundwater recharge are reduced. While the streams and wetlands on the SDC site continue to provide an array of important ecological functions, their ecosystem value and benefits could be expanded.

Sonoma Creek

Sonoma Creek bisects SDC after it flows out of Warm Springs Canyon and heads south towards San Pablo Bay. The 0.8 mile long section of the creek through the SDC property is characteristic of the creek's central reach that runs from Glen Ellen to Schellville. Within the central reach, channel depths range from 20-35 feet and channel slopes range from 0.001 to 0.02 (SEC 2006). Within SDC, channel widths range from 500

feet at its widest to 25 feet at its narrowest (measured from valley-bottom terrace edge to terrace edge, which delineates the active riparian zone). The substrate in the active channel is primarily gravel and cobble, with pockets of sand and silt found in low-velocity zones within the channel and on gravel bars and the inset floodplain benches. Large, coarse-grained, often well-sorted gravel bars occur along the length of Sonoma Creek's SDC reach. The wide, low gravel bars support willow and alder establishment along their edges (see photo below). In many sections, high flows are split between multiple channels that form through and around the gravel bars. This creates beneficial, complex habitat for fish and other aquatic organisms. Sedge clumps are common on the gravel bars and along the channel banks, providing shade and habitat at the water's edge.

Sonoma Creek during summer low flow (looking downstream). Note low gravel bar on right and associated willow and alder establishment, woody debris, and sedge.

Mid-channel cobble bars form riffles that stabilize the channel bed elevation and serve to aerate water during the summer. Pools are formed at bends and in relationship to downed large wood, live mature tree-root complexes, and bedrock or concrete. Downed live trees and woody debris create obstructions in the channel that form complex flow paths. The downed wood also provides shelter and habitat for fish and wildlife. Most of Sonoma Creek through SDC has mature riparian trees lining the steep banks along the channel edge and at the top of bank. These trees provide bank stability, canopy cover for shade, and structural complexity to the channel. In wider sections where the channel has more room to move laterally, there is a more diverse range of riparian tree age and densities. When mature tree roots densely interlock along the lower banks undercuts can form (see photo below). These undercut banks—sometimes up to 3 to 4 feet deep—provide critical habitat for endangered freshwater shrimp and juvenile salmonids.

Mature trees along bank and their root masses with undercut banks and a pool.

The stream banks within SDC are subject to erosion and widening. This is a natural process, especially for deeply incised systems like Sonoma Creek. In the upstream section of Sonoma Creek in SDC, between the first and second Arnold Drive crossings, bank erosion does not threaten structures so it appears to have been left to take its course. It is supplying coarse sediment to the creek, and large cobble bars have formed downstream of the active erosion sites. Bank stabilization is more prevalent downstream of the second Arnold Drive crossing, as this section bisects the main campus and bank erosion in this reach quickly threatens structures. There are multiple sites where past bank erosion has been arrested using rip rap, shotcrete, and concrete bag retaining walls (see photo below). These hardened banks provide little to no habitat value. There are several steep, vertical banks along the lower reach of Sonoma Creek that currently are experiencing significant, active bank erosion. The erosion at one of these sites may compromise nearby buildings and facilities (see photos next page).

Concrete bag retaining wall downstream of the Harney Drive crossing.

Active bank erosion on right bank of Sonoma Creek within the main campus.

Sonoma Creek has a flashy and seasonally variable hydrology typical of the region's incised streams and Mediterranean climate patterns. For example, the average mean discharge during February in the wet winter period is 224 cubic feet per second (cfs) while in September at the end of the dry period it is only 0.75 cfs (USGS 2015b). Peak flows range from 100 cfs (1977) to over 20,000 cfs (2006) as recorded at the USGS streamflow gage (Figure 4).

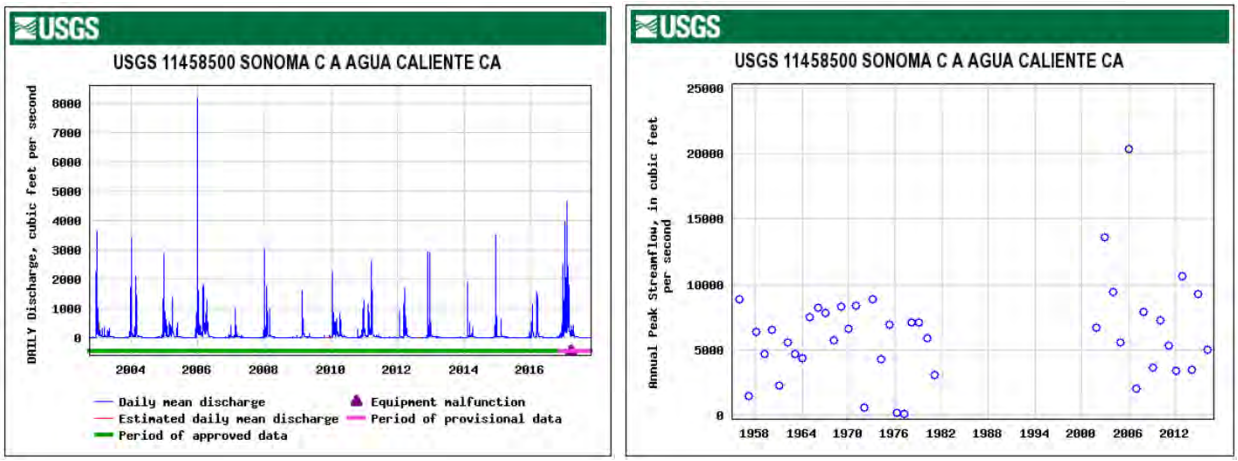


Figure 4. USGS flow data from the gage at Agua Caliente 3 miles downstream of SDC. On left is 15 years of mean daily flows. On right are annual peak flows. Note the increased frequency of large flood events since 2000. Other large flood events not shown on this graph occurred in the region in 1986 and 1995.

Studies indicate that Sonoma Creek is a gaining reach through SDC, in that groundwater is discharging into the creek. During extreme drought conditions, such as in October 2014, the groundwater table is below the stream thalweg and it can become a losing reach (SCWA 2015).

SDC has an appropriative water right to direct divert and divert water to storage from Sonoma Creek. The period of diversion is December 1 to May 1 with a maximum rate of 0.55 cfs (SCWA 2015). The water can be pumped to the water treatment plant, Suttonfield Lake, or Fern Lake. A concrete diversion structure associated with the sump and pumps is located on Sonoma Creek between Arnold Drive and Railroad Avenue. To PCI's knowledge, no assessment of potential impacts of SDC's Sonoma Creek diversions on fisheries has been conducted.

Tributaries

West Side

The two perennial tributaries within SDC are Asbury and Hill Creeks, which drain east from the flanks of the Sonoma Mountains. All of the watersheds on the western side of the property are steep and prone to landsliding and bank instability, especially Asbury along its north side and Hill Creek near Camp Via. The channel beds are composed primarily of boulders, cobbles, and gravel. The fairly steep, cascade-type channels are cut deeply into the hillsides. Landslide activity is highest during wet winters, such as 2017, and creates episodically high sediment delivery rates. Sediment delivered to the creeks moves down the tributaries and to Sonoma Creek in pulses. Trees and branches that fall into the creeks are transported downstream as woody debris, which can form log jams that temporarily store sediment.

Historically, the watersheds on the west side of SDC were logged, as were most of the forested lands in the valley (Nardo-Morgan et al. 1997). The forests have since recovered and mature forest vegetation is present along much of the stream corridors, including dense stands of second growth redwoods and a diverse native understory. Canopy coverage along both drainages exceeds 80% (Rossi & Micheli, undated). Water quality in the watersheds is good with clear, cool water present in summer in the perennial reaches. During the late summer, stretches of Hill and Asbury Creeks may become dry or the pools disconnected.

Asbury Creek drains approximately 1.1 square miles, and extends approximately 2.2 miles as a blue line stream. The middle portion of Asbury Creek is within SDC and the creek forms the northern boundary of the property; the lower 1200 feet is outside of SDC. Asbury Creek is the primary water supply for SDC, providing an estimated 60% of the demand (SCWA 2015). The in-stream diversion structure is located near the upstream, western edge of the property (see photo below). The concrete diversion structure is set flush with the bed of the creek and does not appear to hinder flow or sediment transport when not in use. SDC has a permit to divert up to 1 cfs from Asbury Creek to Fern Lake during their legal period of diversion (October 1 to May 1), provided that a minimum 0.9 cfs flow is maintained in the creek. PCI assumes that the National Oceanic and Atmospheric Administration (NOAA) accounted for fisheries needs in setting these water right restrictions, but has not confirmed this.

According to the SDC water systems' operator, the flashboard dam is not installed until there has been at least 10 inches of rain and a high "first flush" flow event. During large storms the diversion is shut

Asbury Creek diverison structure and pipeline to Fern Lake.

down and the flashboard dam is removed to allow bedload to transport through the diversion structure. Winter baseflow in Asbury Creek ranges between of 0.7 and 3.0 cfs, while summer flows are likely in the range of 0.5 cfs or less (Barber et al. 2012).

Hill Creek drains approximately 1 square mile, and extends approximately 2.7 miles as a blue line stream. The creek runs through or near the southern portion of the property on the west side, from Camp Via to Sonoma Creek. The upper reach of the creek near Camp Via is sinuous, with streambanks in various stages of erosion and recovery (Barber et al. 2012). Metal debris is found throughout the watershed from past water collection endeavors, but the Camp Via area is particularly scattered with historic trash. Hill Creek provides approximately 30% of SDC's water supply (SCWA 2015). An in-channel diversion is located upstream of the Ropes Course, in the southwest corner of property, which transports water to Fern Lake. The diversion is only used during the winter and spring, and it is managed similarly to the one on Asbury Creek. To PCI's knowledge, no assessment of potential impacts of SDC's Hill Creek diversions on fisheries has been conducted.

Although the diversion structure itself has little impact on the channel bed, the banks and channel in the vicinity of the diversion are highly modified and stabilized with gabions and a large concrete culvert and energy dissipater. Downstream of the diversion, Hill Creek is perennial with many springs and seeps along its course. The channel appears to be stable and has complex pool and riffle features that would support steelhead (see photo below). As Hill Creek transitions from the steep hillsides to the valley floor it becomes channelized and encroached upon by development. Bank stabilization, including concrete retaining walls and rock rip rap, is prevalent. The lower channel reaches appear to have experienced recent incision, as there are several perched culverts along the valley floor through the SDC main campus.

Hill Creek downstream of the water diversion structure and the Ropes Course.

East Side

The intermittent streams found on the eastern portion of SDC flow from and across the oak woodlands and grasslands (see photos below). Several of these intermittent streams are man-made ditches created to drain the seasonal wetlands and reduce flooding on the property. Butler Canyon Creek collects water and sediment draining from the eastern side of Sonoma Valley. Its narrow riparian corridor provides refuge for wildlife traversing the valley. The other significant intermittent drainage on the eastern side of SDC feeds and contains Suttonfield Lake.

Examples of the intermittent drainages on the eastern side of SDC; left, at John Mesa Road. Right, within the wet meadow north of Sunrise Road.

Springs

Multiple springs and seeps are found along the western border of the property, especially within the area west and north of Fern Lake. Purportedly several of them feed into the lake. Several seeps were observed along the banks of upper Hill Creek in the vicinity of the Ropes Course. It has been noted that these springs are found in conjunction with interbedded landslide deposits and the near-surface exposure of the Sonoma Volcanics formation (SCWA 2015).

A complex of multiple small, perennial spring-fed watercourses, known as Roulette Springs, forms a primary tributary to Asbury Creek (see photos below). The springs are located between Asbury Creek and Fern Lake near the western edge of the property. SDC has a water right for Roulette Springs with no restrictions on timing or amount of flow diverted. Water is piped to and collected in a spring box, where it is then piped directly to the water treatment plant by gravity feed. The Roulette Springs area supports

redwood overstory with a relatively diverse wetland understory. The substrate is composed primarily of clay, silt, and fine gravels. The extent and quality of this important plant and wildlife habitat may be limited by the water diversion. The area within and around Roulette Springs is littered with old steel and plastic piping.

Spring box and wetlands surrounding the diversion at Roulette Springs.

Reservoirs

Two reservoirs are located on the property. Both are currently used for raw water storage for use at SDC. Fern Lake is near the western edge of the property in a topographical bowl (see photo below). It was constructed in 1921 as SDC's original water supply reservoir. It holds approximately 240 acre-feet of water and is 28 feet deep. The lake is fed by direct runoff and by diversions from Asbury and Hill Creeks. There are two dam faces across Fern Lake, at both the north and south ends. The spillway is at the northern end and feeds into a tributary to Asbury Creek.

Fern Lake, on western portion of SDC.

Suttonfield Lake, on the eastern portion of the property, holds 600 acre-feet. Constructed between 1931 and 1938, the lake flooded an unnamed tributary to Sonoma Creek (Barber et al., 2012). The dams are on the south side of the lake. A cement-lined spillway is on the dam closest to Arnold Drive, which directs flow down an intermittent creek to Sonoma Creek. Suttonfield Lake is filled by direct runoff and with water transferred from Fern Lake and diversions from Sonoma Creek.

Suttonfield Lake, on eastern portion of SDC.

In addition to the two large reservoirs, there are two small perennial ponds that appear man-made. One is located on the far eastern side of the property between two hillsides. It is approximately 0.3 acre in size and is at the upstream end of a large wet meadow. The other is adjacent to the water storage tanks along Orchard Road, and is less than 0.1 acre.

Pond above wet meadow on east side of SDC.

Groundwater

Groundwater is found in numerous geologic formations throughout the Sonoma Valley at varying depths, and SDC is within the Sonoma Valley Groundwater Management Program area. The Sonoma County Water Agency assessment describes the various geologic formations and groundwater level trends for wells that draw from specific formations (SCWA, 2015). The overall findings from the analysis of well data in the SDC vicinity are that:

- Groundwater levels in shallow wells completed within the Quaternary alluvial deposits both north and south of the site appear to be relatively stable.
- Groundwater levels in shallow wells north of the site completed within the Glen Ellen formation exhibit moderate declining trends and may be influenced by local groundwater pumping.
- Limited data on deep wells completed within the Glen Ellen or Sonoma Volcanics formations north of the site appear to show either recent recovery or stability.
- Data is not available on intermediate and deeper groundwater zones near the southern portion of SDC; declining groundwater has been documented in the El Verano area south of SDC.

The SCWA report (2015) recommends that land use practices within the upper, western portions of the SDC property "should be carefully managed to avoid water quality impacts to the shallow groundwater system within the Sonoma Volcanics, which discharge as the springs and seeps that contribute to the existing water supply system" and also that "care should be taken to limit the potential for any additional groundwater development to impact spring and stream flows at the SDC property."

Groundwater recharge in the region is through streambeds and precipitation infiltration. On SDC, the

principal method is through direct infiltration of precipitation, as the creeks appear to primarily gain water from the discharge of shallow groundwater. The amount of water that can be intercepted and infiltrated into the soil to recharge the groundwater is dependent upon soil type, slope, vegetation, and geology. Mapping of these characteristics across SDC indicates that groundwater recharge potential varies from very good to poor, with the areas of highest potential in the eastern portion of the property, the flat alluvial areas adjacent to Sonoma Creek, and in a narrow band around Fern Lake on the western property boundary (SEC and SCWA 2014). Average annual recharge volume is estimated to be 640 acre feet per year, with a range of 45 to 1,430 acre feet. However, much of this recharge volume likely re-emerges on or near the property at springs, seeps, and stream baseflows.

With half of Sonoma Valley's water supply dependent on local groundwater, preserving the rainwater capture and infiltration capacity of the undeveloped SDC landscape is a highly cost-effective way to support recharge and sustain flows for steelhead, California freshwater shrimp, and other aquatic species in Sonoma Creek. The Basin Advisory Panel (Panel), a group of twenty stakeholders representing varied water interests, has been working together since 2006 to manage Sonoma Valley groundwater resources in a sustainable way that meets both ecological and water supply needs. The Panel created the non-regulatory Sonoma Valley Groundwater Management Plan, which was subsequently adopted by the Sonoma County Water Agency, City of Sonoma, Valley of the Moon Water District, and the Sonoma Valley County Sanitation District. The report presents a range of voluntary water management options, including enhanced groundwater recharge, conjunctive use of surface water and groundwater, increased conservation, and greater use of recycled water. Studies by the Sonoma Ecology Center and Sonoma County Water Agency (2011) and GEI Consultants (2013) identified the SDC property as a potential location for a groundwater recharge project.

Three groundwater wells are located on the SDC property. They are:

- One shallow groundwater well that is used only for turf irrigation of the soccer fields on John Mesa Dairy Road,
- A well located near Suttonfield Reservoir, and
- A well located at Camp Via for water supply at the camp. It is 195 feet deep and has an annual production less than 50,000 gallons per year (SCWA 2015).

5 Soils

Biological diversity at SDC is supported by a diversity of soil types, which in turn derive from diverse terrain and geology and the biotic and abiotic forces that create soil. The site is within the Coast Range Geomorphic Province, which is characterized by basement rocks of the Franciscan Complex (about 200 million years to 65 million years before present) with sporadic overlays by remnants of geologically younger formations (Dwyer 2001). The structure of the Province is northwest-trending, with major faults and folds, and mountains and valleys, all oriented in that direction. The Province is tectonically active with many active faults associated with the San Andreas Fault system. The resulting earthquakes and ongoing mountain building have resulted in steep mountain fronts with a high incidence of landslides and erosion.

Southeastern Sonoma County, SDC's region, is underlain by a deformed geologic structure referred to as the Santa Rosa block (Dwyer 2011). This consists of relatively young continental, near shore, and volcanic rocks, which have been folded and faulted into the older basement rocks of the Franciscan Complex. These formations include, from oldest to youngest, the Petaluma Formation, the Sonoma Volcanics, and the Glen Ellen Formation. The Petaluma Formation is characterized by beds of clay, shale, silt, sand, and

gravel, with local interbeds of tuff and diatomite. These are thought to represent deposits from rivers, lakes, and brackish lagoons or bays accumulated in Miocene times (approximately 7.1 to 5.5 million years before present). The Sonoma Volcanics overlay the Petaluma Formation. These consist of a complex series of lava flows and tuff beds. The most common rock is basalt and basaltic andesite, with rhyolite domes and plugs. The Glen Ellen Formation consists of more recently deposited layers of gravel, sand, tuff, and silt, with thick layers of conglomerates. These are primarily alluvial fan and landslide deposits.

Nine soil types are mapped within SDC (NRCS 2017). In general, soils in the hilly portions of the site are derived from Sonoma Volcanics materials, while soils in gentler terrain are derived from alluvium. Most of these soils are moderately or well-drained, with the exception of Huichica loam (in the central campus), which can be somewhat poorly drained. Permeability is generally slow to moderate, and erosion hazard ranges from slight to high, depending on slope. The table below lists soil types mapped on the site, with ecological traits relevant to planning future land use and stewardship. Key processes that influence the site's soils include the flows of water and associated erosion or deposition, plant growth and decay, agriculture/livestock uses, trail and road uses, and other grading or site development.

Table 1. Soil Types Mapped on the Sonoma Developmental Center Property
Based on NRCS (2017), USDA (1972)

Soil Type & Typical Slopes	General Location at SDC	Underlying Material	Typical Vegetation/ Vegetation at SDC	Drainage/ Permeability (Hydrologic Soil Group[2])	Runoff/Erosion
Clough gravelly loam, 2-9%	Developed area east of creek (old bench terrace of creek)	Alluvium; very gravelly clay subsoil, indurated hardpan at 12-34".	Oaks, manzanita, poison oak, grasses/ Developed, oak woodland, wetland	Moderately well-drained/ Very slow (D)	Slow to medium/ Slight to moderate
Goulding clay loam, 5-30%	Upper slopes	Sonoma Volcanics bedrock at 12-24"	Scattered oaks, shrubs, and grasses/ Forest, woodland	Somewhat excessively drained/ Moderate (C)	Medium to rapid/ Moderate to high
Huichica loam, 2-9%	Developed area west of creek – central campus	Strongly cemented valley alluvium at 25-40"	Grassland, scattered oaks/ Developed, remnant oaks	Somewhat poorly- to moderately well-drained/ Very slow (C)	Slow to medium/ Slight to moderate
Laniger loam, 30-50%	Small knoll on eastern edge of property	Weathered rhyolite and tuff at 18-45"	Blue oaks, live oaks, manzanita, ceanothus, poison oak, brush and grasses/Oak woodland	Well- to somewhat excessively-drained/ Moderate (C)	Rapid/High

[2] Hydrologic soil groups classify infiltration rate when thoroughly wet: A-high; B-moderate; C-slow; D-very slow.

Soil Type & Typical Slopes	General Location at SDC	Underlying Material	Typical Vegetation/ Vegetation at SDC	Drainage/ Permeability (Hydrologic Soil Group[2])	Runoff/Erosion
Los Robles gravelly clay loam, 0-5%	Along Butler Canyon Creek and bend of Sonoma Creek north of central campus	Gravelly sandy clay loam subsoil, underlain by mixed alluvium at 36-48"	Grassland, scattered valley or live oaks/Oak woodland	Moderately well-drained/ Moderately slow (C)	Slow/Slight
Red Hill clay loam, 2-30%	Northeastern agricultural area, western edge of Fern Lake, Camp Via	Sonoma Volcanics, basalt at 30-60"	Douglas fir, madrone, oaks, and shrubs/Dairy, grassland, woodland	Moderately well-drained/ Moderately slow (C)	Medium to rapid/Moderate to high
Riverwash	Along Sonoma Creek	Recent depositions of gravel, sand and silt	Riparian herbaceous species, shrubs and trees/ Riparian forest	(Well-drained)/ (Rapid; no rating)	n/a/(High)
Spreckles loam, 2-30%	Mid-slopes	Clay subsoil underlain by volcanic ash at 22-60"	Oaks, madrones, manzanitas, poison oak, perennial grasses/Oak woodland	Well-drained/ Slow (D)	Medium to rapid/Slight to high
Tuscan cobbly clay loam, 0-9%	Eastern edge of property	Indurated hardpan of igneous materials at 10-25", on bench terraces	Grasses, shrubs/Oak woodland	Moderately well-drained/ Slow (D)	Slow to medium/ Slight to moderate

6 Biological Resources

Diverse terrain and soils, valuable water resources, a history of limited land development, and connectivity with adjacent natural lands all contribute to SDC's rich biological resources. Vegetation types range from low-lying grasslands used historically for livestock grazing to dense native forests high on the slopes of Sonoma Mountain. Many species of wildlife make use of these varied settings. The site's streams support imperiled salmonids, amphibians, and invertebrates; its forests and woodlands provide forage and shelter for many bird and mammal species; its grasslands support many common reptiles and raptors; and even the central campus itself provides resources to bats and birds.

Plant Communities

Vegetation on the site reflects the influences of terrain and human uses of the land. Upper portions of the property, on the western side, are dominated by dense, shady forests and redwood groves. Midslopes, in the central part of the property, are dominated by deciduous oak woodlands. Near the center of the

property, a corridor of riparian woodland follows Sonoma Creek from north to south. The easternmost part of the property, with its gentle terrain, has been used more extensively for agricultural purposes and supports grassland with scattered mature oaks. In addition to these primary vegetation types, there are several other plant communities of note. Wetland vegetation occurs in narrow slivers along the periphery of the lakes, in isolated low-lying pockets in grassland and forest, and in the eastern grassland. Stands of coyote brush are present in some grasslands in the process of succession toward oak woodland. Even the developed core campus supports valuable vegetation, including many large, mature landscape trees as well as remnant natives.

SDC's vegetation also reflects a history of land use. Starting in the mid 1800s, timber was cut for Colonel Mariano Vallejo's mill at the mouth of Asbury Creek (Berber et al 2012). Redwoods were nearly clear-cut in the effort to rebuild San Francisco and local communities after 1906 earthquake. Oaks were harvested for fuel in mid 1900s, and tanoaks were harvested for their tannins, used in preparing leather. Open areas have a long history of livestock use.

Exhibits 2a-d provide maps of SDC's vegetation types. These are based primarily on a recently completed countywide, fine-scale vegetation classification and mapping effort (SCAPOSD 2017). That work entailed a combination of detailed fieldwork for classification development, mapping fieldwork that informed computer-based map development, and extensive map editing. PCI then refined these delineations based on our own fieldwork. Refinements focused on sensitive habitats including wetlands. Most map classes are alliances named for the dominant or distinguishing species (e.g., coast redwood forest, Oregon oak woodland). Others consolidate several alliances, where distinguishing alliances was not possible due to the complexity of vegetation or the difficulty of distinguishing it based on available data. The table below lists vegetation classes mapped on the site. For classes that include multiple alliances, component alliances are also shown. Map classes or alliances considered sensitive based on CDFW ranking (Klein et al. 2015) or State and local policies are shown with an asterisk.

Table 2. Vegetation Types, Map Classes, and Sensitivity

Vegetation Type	Map Class (Sensitive classes shown with asterisk)	Acreage on SDC
Mixed Evergreen and Redwood Forests	California Bay Forest	42
	Coast Redwood Forest*	22
	Douglas-fir Forest	2
	Madrone Forest*	1
Oak Woodland	Blue Oak Woodland	69
	Mixed Oak Woodland	251
	Oregon Oak Woodland*	26
	Valley Oak Woodland*	33
Riparian Forest	Bigleaf Maple Forest*	0.2
	Fremont Cottonwood Forest*	1
	Vancouverian Riparian Deciduous Forest* (includes white alder, Oregon ash, and shining willow alliances)	24

Vegetation Type	Map Class (Sensitive classes shown with asterisk)	Acreage on SDC
Grasslands	Annual and Perennial Grassland (includes wild oats-annual brome grasslands, and sensitive native needlegrass grasslands*, California oatgrass prairie*)	213
Wetlands	Freshwater Marsh and Wet Meadow* (includes perennial rye grass fields, creeping rye grass turfs, bulrush marsh, Harding grass swards, and others)	35
Other	Coyote Brush Scrub (see Oak Woodland text section for discussion)	12
	Himalayan Blackberry Brambles (see Wetlands text section for discussion)	3
	Non-native Forest (including ornamental plantings)	24
TOTAL		**758**

A list of plant species observed on SDC is provided in Appendix A. This appendix also provides Latin names for all species mentioned in the following text.

The sections below describe each of the major vegetation types on the property, providing an overview of their distribution, structure, composition, habitat quality and limitations, the primary ecological processes that shape each habitat, and the main ecosystem services that each provides. See Section 7 for further discussion of human impacts to habitats, climate change, and ecosystem services.

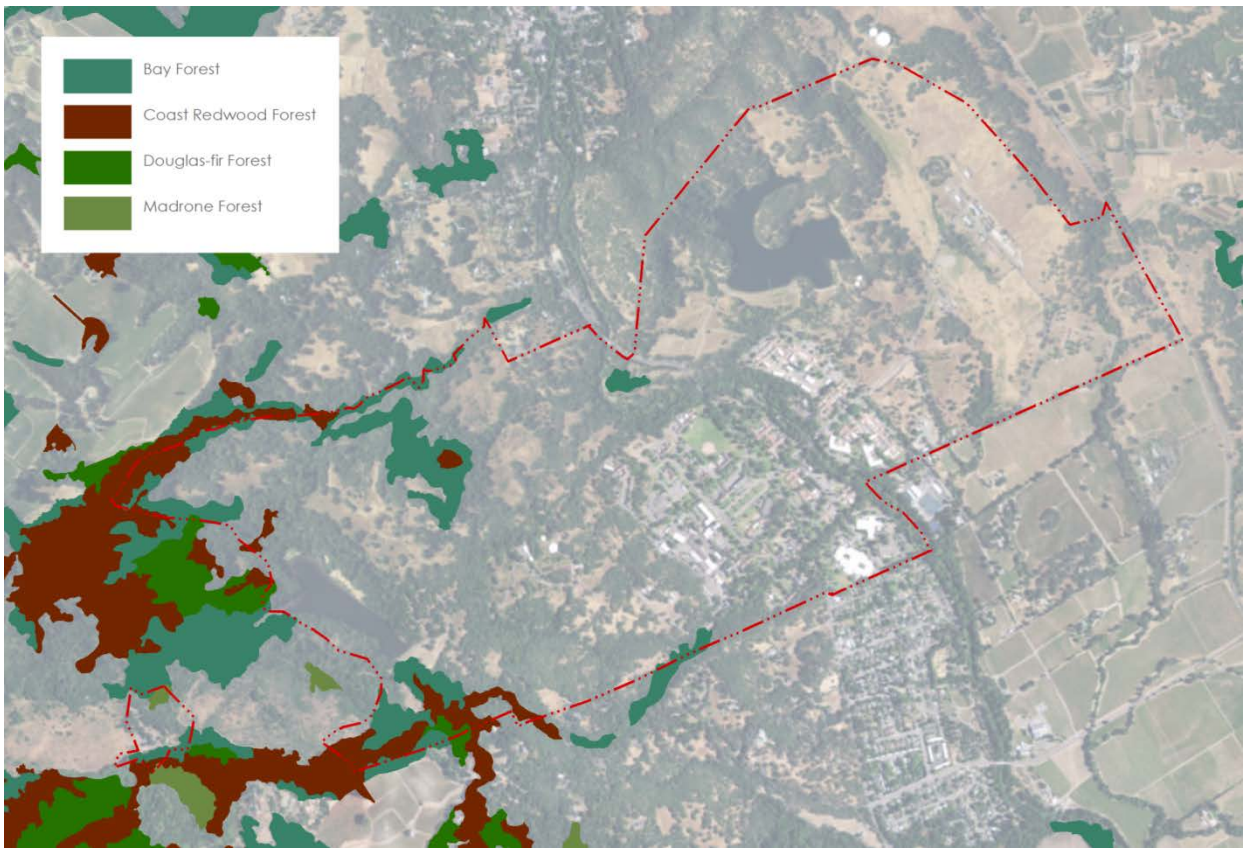


Figure 5. Distribution of mixed evergreen and redwood forests at SDC and in vicinity.

Mixed Evergreen and Redwood Forests

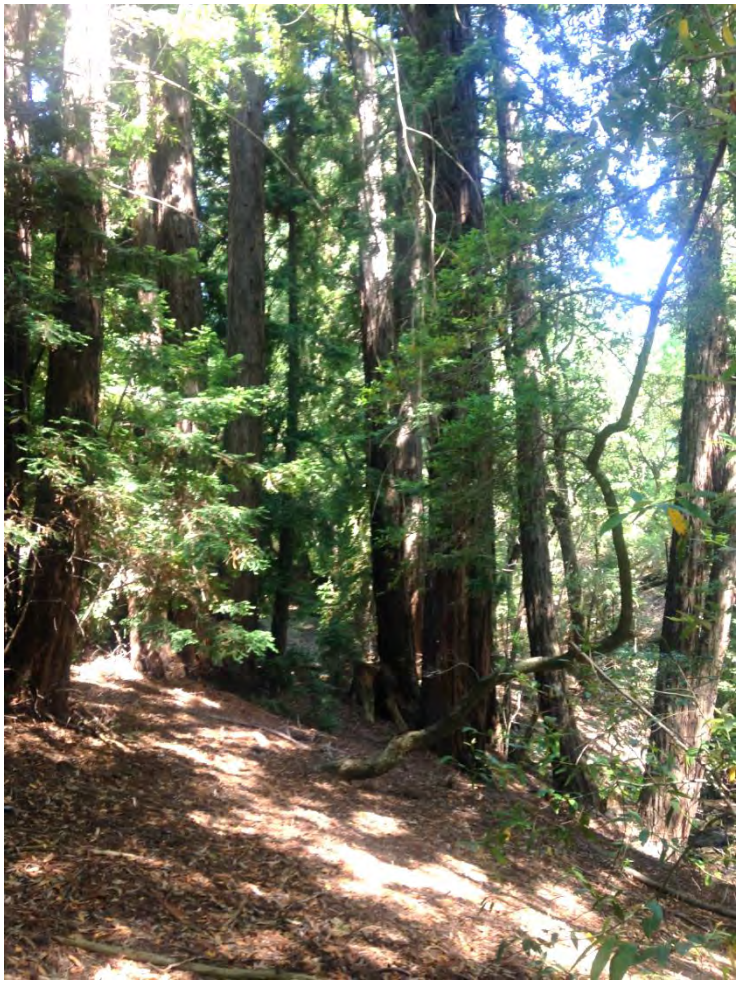
Mixed evergreen forests dominate the western part of SDC, occupying approximately 70 acres. A changing mosaic of coast live oaks, California bays, Douglas-firs, and madrones creates a dense canopy, with a limited understory of herbs and shrubs in their shade. On moister slopes, black oaks and big leaf maples can be found. Along the major drainages of upper Hill Creek and Asbury Creek, there are several stands of second or tertiary-growth redwoods, up to 4' in diameter at breast height.

In openings where more sunlight reaches the forest floor, tree seedlings and saplings, shrubs, and herbs occur. These are mostly native species, including shrubs (poison oak, hazelnut, thimbleberry, and snowberry); herbs (Pacific sanicle, soaproot, hounds tongue, goldback fern, sword fern, and lady fern) and grasses (small-flowered melic, woodland brome). Western chain fern grows in seeps or isolated low spots where water collects. Invasive species are uncommon in these forests, occurring primarily in disturbed locations. However, Scotch and French broom are present along some roads and trails, and Himalayan blackberry occurs in some forested wetlands.

The forests on the property are relatively intact and undisturbed, with a diverse suite of natives and few introduced species. Sudden Oak Death, the forest disease caused by the pathogen *Phytophthora ramorum*, is known to occur within Jack London SHP. Confirmed cases are documented in bays and coast live oaks on Jack London SHP near Asbury Creek (Oak Mapper, 2017), and the disease is highly likely to be present on the SDC site. However, no large stands of affected trees are currently apparent and no formal assessment of infection has been done. In 2002, Sonoma Ecology Center staff noted that SOD appeared

to be the cause of death for several large coast live oaks and black oaks, as well as madrones and tanoaks, on the property (SEC 2002). Related pathogens *P. cimmamomi* and *P. cambivora* have also been identified as present within Jack London SHP.

SDC's forests are continuous with extensive evergreen forests to the west, as well as to the north and south, on the lower flank of the Sonoma Mountains. Portions of these adjacent lands, however, have been cleared for vineyard.



Redwood grove along Hill Creek drainage.

In addition to disease and natural regeneration, other key ecological processes that affect SDC's forests include fire and climate change. These forests have evolved with fire; oaks, bays, and redwoods in particular can survive or resprout from fire, depending on temperatures and frequencies. Moderate fires may be important to maintaining forest diversity. Long-term buildup of fuels and/or drought-stressed trees—which may accompany changing climate or disease outbreaks--may result in more damaging fires. Climate change may also reduce natural regeneration and long-term tree health; redwoods and other moisture-dependent forest species are especially at risk.

The forests of SDC serve important functions of biodiversity conservation, wildlife habitat and connectivity, carbon sequestration, climate regulation, air quality protection, soil conservation, nutrient cycling, and water supply and water quality protection.

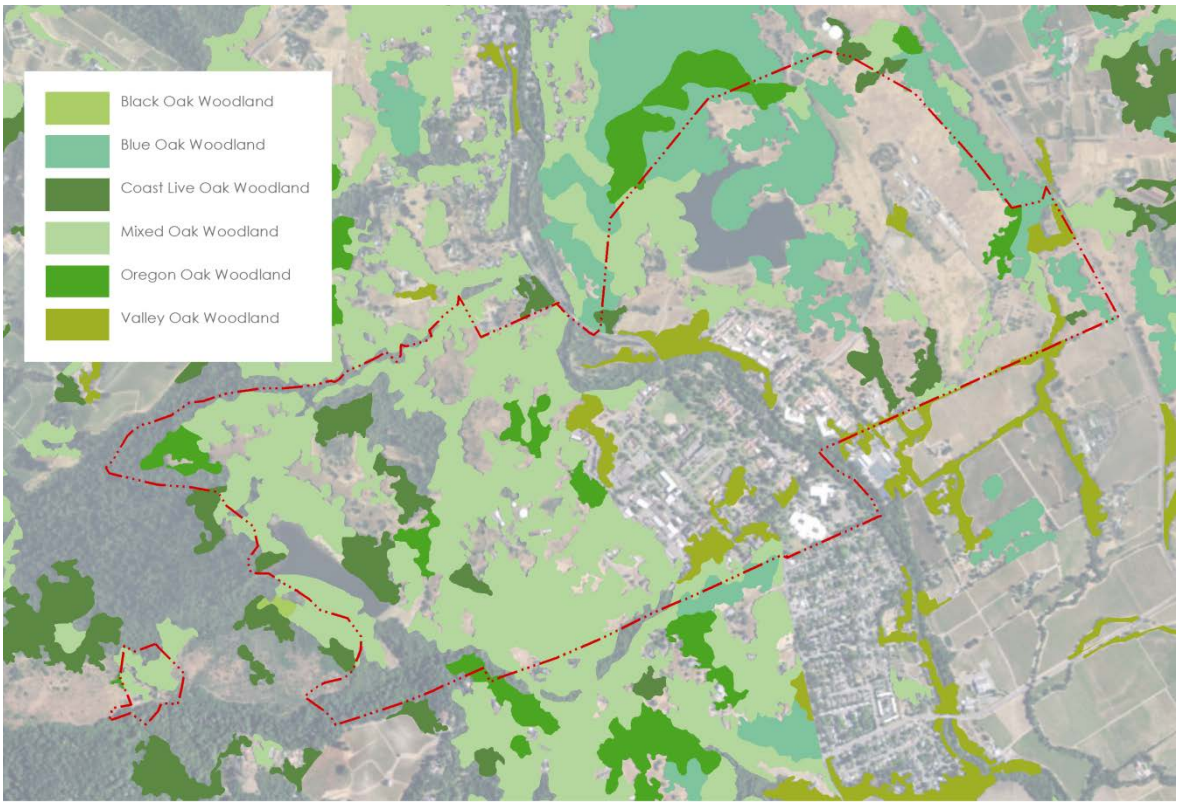


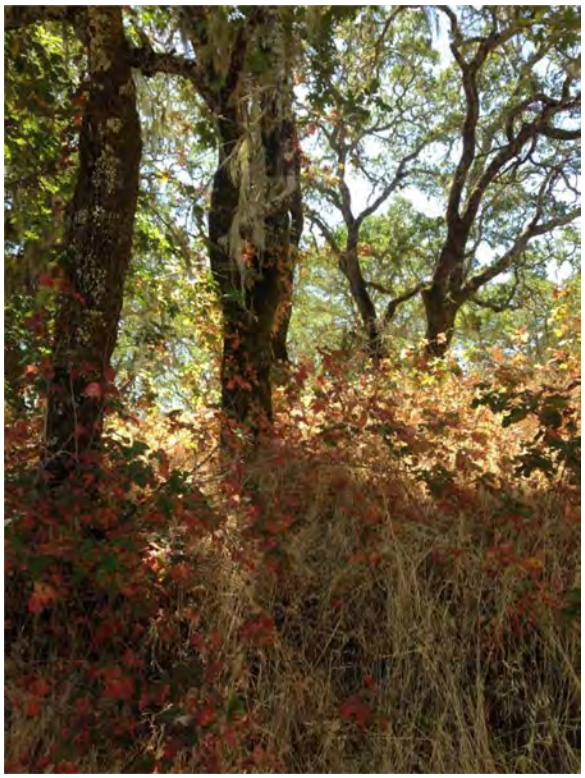
Figure 6. Distribution of oak woodlands at SDC and in vicinity.

Oak Woodland

Oak woodlands dominate the central part of SDC, occupying approximately 380 acres the gentle hills on both sides of the central campus. These are characterized by a deciduous canopy of Oregon, blue, black, and valley oaks, which is nearly continuous in some areas and open and savanna-like in others. Coast live oaks and occasional bays are often present in drainages.

The dappled shade to full sun provided by these woodlands allows for a varied and well-developed understory. Depending on canopy density, this can include shrubs (common manzanita, poison oak, coffeeberry, wood rose), native perennial grasses (California fescue, blue wildrye, California oatgrass), vines (Dutchman's pipevine, California honey-suckle), and herbs (yarrow, soaproot, Pacific sanicle, Ithuriel's spear, milk maids, hounds tongue, Indian warrior, milkwort). Regenerating seedling or sapling madrones, oaks, and bays are also common.

Several areas of the property have scattered oaks in a grassland setting. These savanna-like areas are found on relatively level land within the denser woodlands on the west side of the property, as well as within the grassland and agricultural lands on the east side of the property. Valley oaks and blue oaks are more common in these areas; some of the valley oaks are large, spreading specimens. Typically, coyote brush, manzanita and regenerating trees are also abundant, suggesting that these areas may be in transition toward more typical woodland habitat over time. These areas, with their gentle terrain, may have been grazed by livestock in the past, and when grazing was ended, tree regeneration may have been released. Where livestock grazing continues, as on the eastern edge of the property, natural regeneration is limited. In addition to shrubs, there is extensive grass cover in these areas, with both native (California oatgrass) and non-native (annual bromes, Harding grass, and wild oats) species common.



Typical oak woodland understory of poison oak and annual grasses.

Where the oak woodlands occur on slopes and steeper locations on SDC, they have been less heavily disturbed by human activities and retain a native-dominated understory. The savanna-like, more open-canopied oak stands in gentler areas have a larger non-native component in their understory. Dense infestations of invasive broom are present in a number of disturbed locations along roads and trails, especially in the area north of campus and west of Sonoma Creek, and areas near Suttonfield Lake. Yellow starthistle is also common along trails through woodland in these areas.

Natural regeneration of trees is visible in many areas. These oak woodlands are remnants of more extensive oak habitat that once lined the Valley of the Moon but which has been fragmented by human settlement and land use.

In addition to grazing and natural regeneration, other key ecological processes that affect SDC's woodlands include climate change and fire. Climate change may reduce natural regeneration and long-

Natural regeneration of oaks.

term tree health. As noted above, California oaks have evolved with fire and frequently survive or resprout from fire, unless temperatures or frequencies are unusually high. Fuel loads in SDC's oak woodlands are generally moderate. Long-term buildup of fuels and/or drought-stressed trees—which may accompany changing climate—may result in more damaging fires. Portions of the oak woodland on the east side of the property burned in the Nuns Fire of October 2017. Mature trees appear to have been killed in some locations, especially near structures, which provided dense fuel sources. Away from structures, oak canopies frequently appeared to have been partially or mostly killed by heat. However, new growth was observed on many of these trees in November 2017, indicating recovery is likely. Apparently intact acorns were also observed on the ground. The burn appeared relatively patchy and roughly 30% of mature trees within denser oak stands appeared not to have been damaged by the fire. A spring 2018 review of site conditions is recommended to assess status, outlook, and restoration needs for oak woodlands in this area more definitively.

The oak woodlands and savannahs of SDC serve important functions of biodiversity conservation, wildlife habitat, carbon sequestration, soil conservation, and water supply and water quality protection.

Blue and Oregon oak woodland.

Black oak.

Above: Oak woodlands east of Arnold Drive in Novermber 2017, after the October wildfires. Brown leaves were killed by heat, but in many cases these trees are already showing new growth. Mostly intact trees (leafless at this season) in background. Green new grass visible in foreground.

Right: Oak along Harney Drive with canopy killed by October wildfire, but growing new foliage (center of photo) one month later.

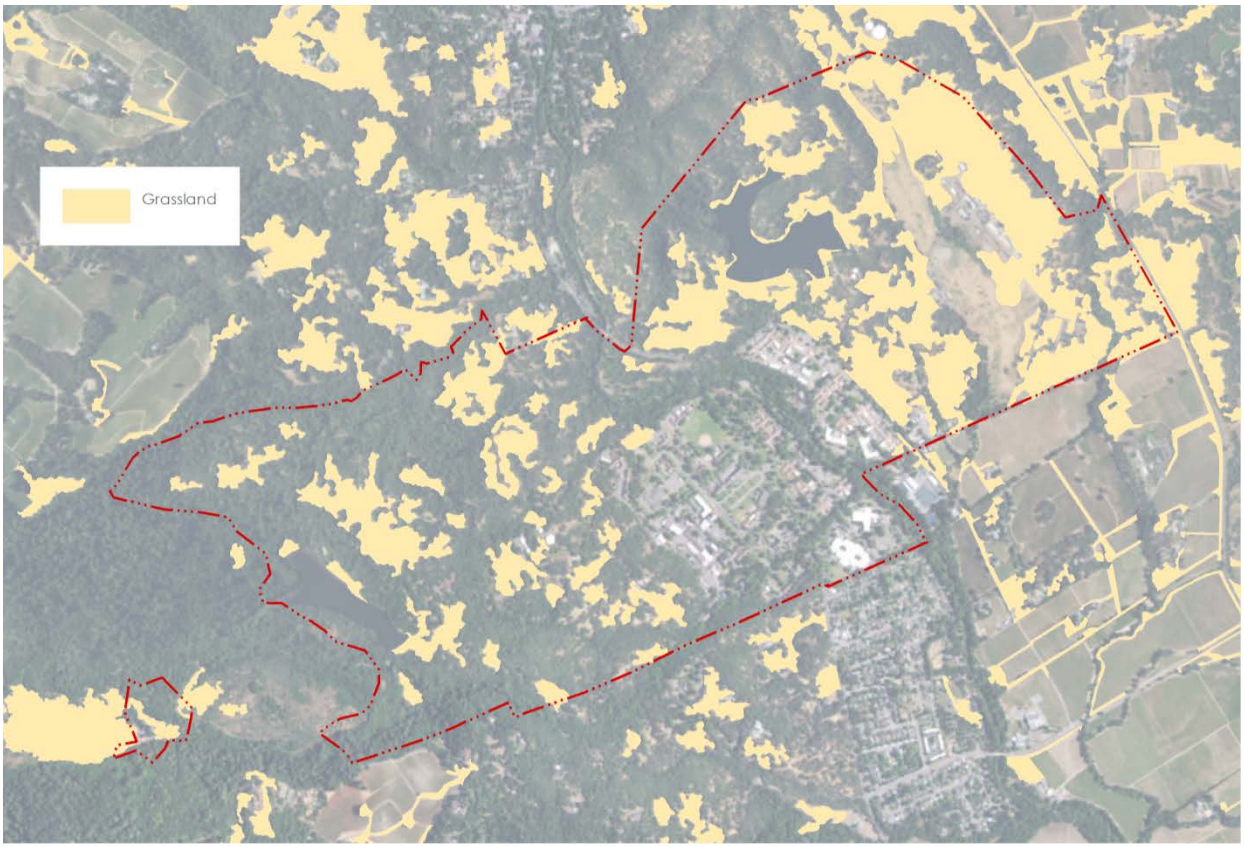


Figure 7. Distribution of grassland at SDC and in vicinity.

Grasslands

Grasslands dominate the eastern side of SDC, and also occur in patches interspersed with the woodlands on the slopes of the western side. They occupy approximately 210 acres. The eastern grasslands, used for agricultural purposes historically, are primarily composed of non-native annuals. The smaller patches of grassland to the west typically have a strong component of native perennial grasses within a matrix of annual species. Scattered mature oaks are also present in most of the grasslands.

The perennial bunchgrass-dominated habitats have clumps of long-lived grasses interspersed with forbs and annual grasses. California oatgrass and purple needlegrass are the most abundant bunchgrasses, with occasional patches of California brome, blue wildrye, foothill needlegrass, and one-sided bluegrass. Native perennials are common, including milk maids, blue-eyed grass, California buttercup, narrow-leaved mule's ears, soap root, yellow mariposa lily, and hedge nettle. Native annuals including tarweeds and purple clarkia are present in low numbers. Many of the non-native forbs and grasses found in the site's annual grasslands are also present here.

Non-native annual grassland occurs throughout the eastern portion of the site. This grassland type is more homogeneous in structure than native grassland. The dominant annual grasses form a uniform cover rather than the patchy cover provided by perennials. Non-native forbs are common, while native forbs occur sporadically at low cover. Dominant grasses are ripgut brome, wild oats, and soft chess. Common non-native forbs are cutleaf geranium, vetches, red stemmed filaree, Italian thistle, and hairy cat's-ear. Invasive species including fennel, yellow star thistle, Klamathweed, and medusahead are also common.

Typical grassland on upper western slope of SDC.

The natives present include the disturbance-adapted common fiddleneck, miniature lupine, and California buttercup. Weedy invasive species are especially common along roads and trails and near structures.

As described in the *Oak Woodland* section above, coyote brush is common in some areas transitional between grassland and woodland. Coyote brush is a disturbance-adapted species that often facilitates the re-establishment of oaks in previously logged, grazed or otherwise disturbed areas, providing shade for the seeding oaks and then dying out as the oaks in turn shade the coyote brush.

Within low-lying grasslands, a few seasonal wetlands are present; see *Wetlands* section below.

In comparison with other Sonoma County grasslands of similar extent and use history, SDC's grasslands have a strong component of native species and limited invasive species infestations. Most of the upper grasslands have a substantial element of native perennial grasses. On adjacent properties, most low-lying grasslands have been developed for row crops or vineyard, making SDC's eastern grassland, with its scattered oaks, an important remnant habitat.

Key ecosystem processes in SDC's grasslands include grazing, succession, and fire. Historic livestock grazing has strongly shaped most of the grasslands of the county (and the State), and SDC is no exception. Current livestock use is relatively light. Future livestock management methods will play an important role in the fate of native grassland stands and the spread of invasive species. Succession is occurring in some areas as apparently disturbed areas transition from grassland to shrubland, and likely to woodland in the future. California grasslands are adapted to fire, with annual species typically reseeding readily and perennial species surviving most fires unless burn temperatures are unusually elevated. The adjacent Bouverie Preserve, Sonoma Mountain Ranch, and other conservation landowners in the region are experimenting with the use of prescribed fire to encourage native grassland diversity. Grassland east of Arnold Drive burned in the Nuns Fire of October 2017. Dense new growth was already present by PCI's November visit. The burn may have a limited effect on species composition in the grassland but is not

expected to have long-lasting effects unless fire fighting efforts introduced new species.

Native grasslands on SDC serve important functions of wildlife habitat, biodiversity conservation, soil conservation and water quality protection, and carbon sequestration. Non-native annual grasslands provide similar functions, but to a lesser degree. The grasslands have also served to support livestock grazing.

Yampah, native bulb common in less-disturbed SDC grasslands Yampah once served as an important food s

Native oatgrass visible along trail.

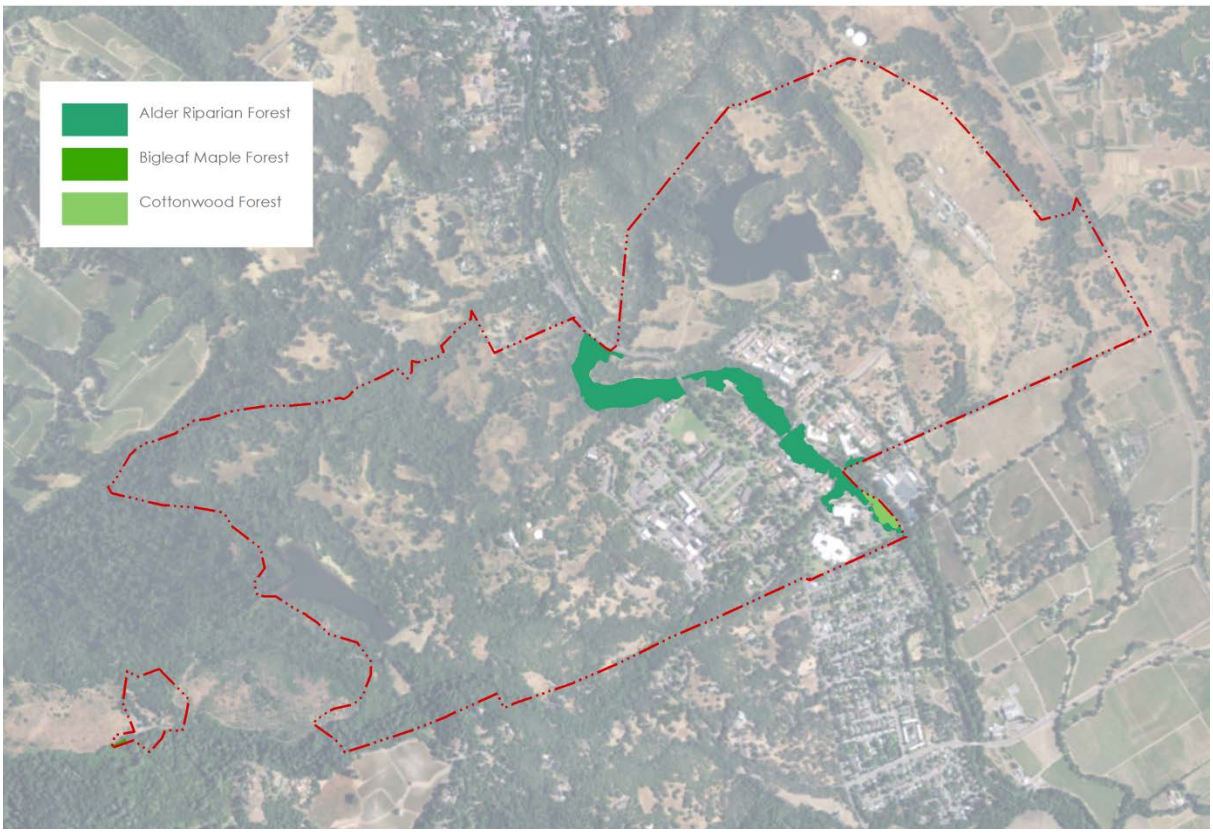


Figure 8. Distribution of riparian-specific forest types at SDC and in vicinity. (Bigleaf maple forest only present in small patch at southwest edge of Camp Via. See also other forest and woodland maps above for additional vegetation associated with streams.)

Riparian Forest

Riparian forest follows the course of Sonoma Creek through the property, occupying approximately 25 acres. The width of the riparian woodland along Sonoma Creek is typically 150-300'; in some areas this is further buffered from development by other oak woodland types. Sonoma Creek's total riparian corridor is widest at the northern end of the property, where the creek meanders away from Arnold Drive. The width of the Asbury Creek riparian corridor is relatively unconstrained by development, shaped instead by terrain and access to water. The Hill Creek riparian corridor is limited where it flows through campus; some buildings are as close as 25-30' from the creek thalweg, and for most of this reach, there is only one tree canopy-width of native vegetation present on each side of the creek.

Along Sonoma Creek, white alders line the channel. Bays and oaks are abundant on the banks, bigleaf maple is common, and stands of willow occur in scattered locations. Along the tributaries to Sonoma Creek, narrow bands of alders continue in lower locations but redwoods, bays, maples, and other trees of the mixed evergreen forest are dominant higher in the watershed. Occasional Oregon ash trees are also present. Some dieback of alders was noted, which may reflect recent drought conditions.

Alder-dominated riparian forest along Sonoma Creek, in winter.

The understory along Sonoma Creek is comprised of a dense tangle of shrubs, vines, and herbs. Immediately along the active channel, native torrent rush is common. Occasional mugwort, horsetail, and sedges are present at channel edges. Upslope of the active channel, vegetation is largely non-native, as is typical of Sonoma County's major creeks. Himalayan blackberry and vinca are abundant. Invasive giant reed (arundo) occurs in patches.

Along the tributaries, these same invasive species are common in the understory of the lower reaches. French broom is dense in some places, and wild plums are also common. Further upstream, the understory is dominated by native species such as spicebush, hazelnut, dogwood, elk clover, torrent sedge, sword fern, and lady fern.

Riparian woodland along Sonoma Creek and upper Hill and Asbury Creeks includes native understory shrubs like spicebush.

As in other habitats, invasive species along the creek can limit native plant diversity, change habitat structure, alter hydrology, and exacerbate erosion concerns. Invasive species are typically fast-growing and often create very dense stands, excluding other species with their intense competition for space, light, and water. As a result, the multiple layers of vegetation in a healthy native riparian setting—from herbs and shrubs to vines and trees—can be reduced to a single layer of vegetation, such as Himalayan blackberry. This in turn reduces wildlife habitat diversity. The loss of varied native plant types, with their varying root structures, can also mean reduced erosion resistance. For

instance, Himalayan blackberry, with its relatively shallow roots, does not protect stream banks as well as a native mix of fibrous-rooted sedges and rushes with trees like oaks and alders, which are extensively rooted at multiple depths.

The riparian woodland on SDC is relatively wide in most areas and provides valuable shade and inputs of organic matter to the creek, supporting salmonids and other aquatic life. Despite the presence of invasive species, there are sufficient openings to allow native riparian trees to regenerate. The corridor is contiguous with riparian woodland upstream and downstream of the property, as well as being connected with intact upland habitats.

Key ecological processes in SDC's riparian habitats include climate change and water flows. These two interrelated processes directly drive riparian characteristics. As flows become more variable and temperatures increase, riparian vegetation is likely to undergo drought stress and could diminish in extent. Levels of water diversion also influence the extent and health of riparian plant communities.

Riparian corridor along upper Hill Creek, dominated by redwood and bay.

Stream corridors and their adjacent vegetation serve important functions of wildlife habitat and connectivity, climate change refugia, soil conservation and water quality protection. SDC's riparian woodland is especially valuable as its width and connection to upland habitats increase its value for wildlife habitat and movement, tree regeneration and recruitment, and temperature buffering.

Riparian habitat along lower Hill Creek includes dense infestations of Himalayan blackberry and other invasive species.

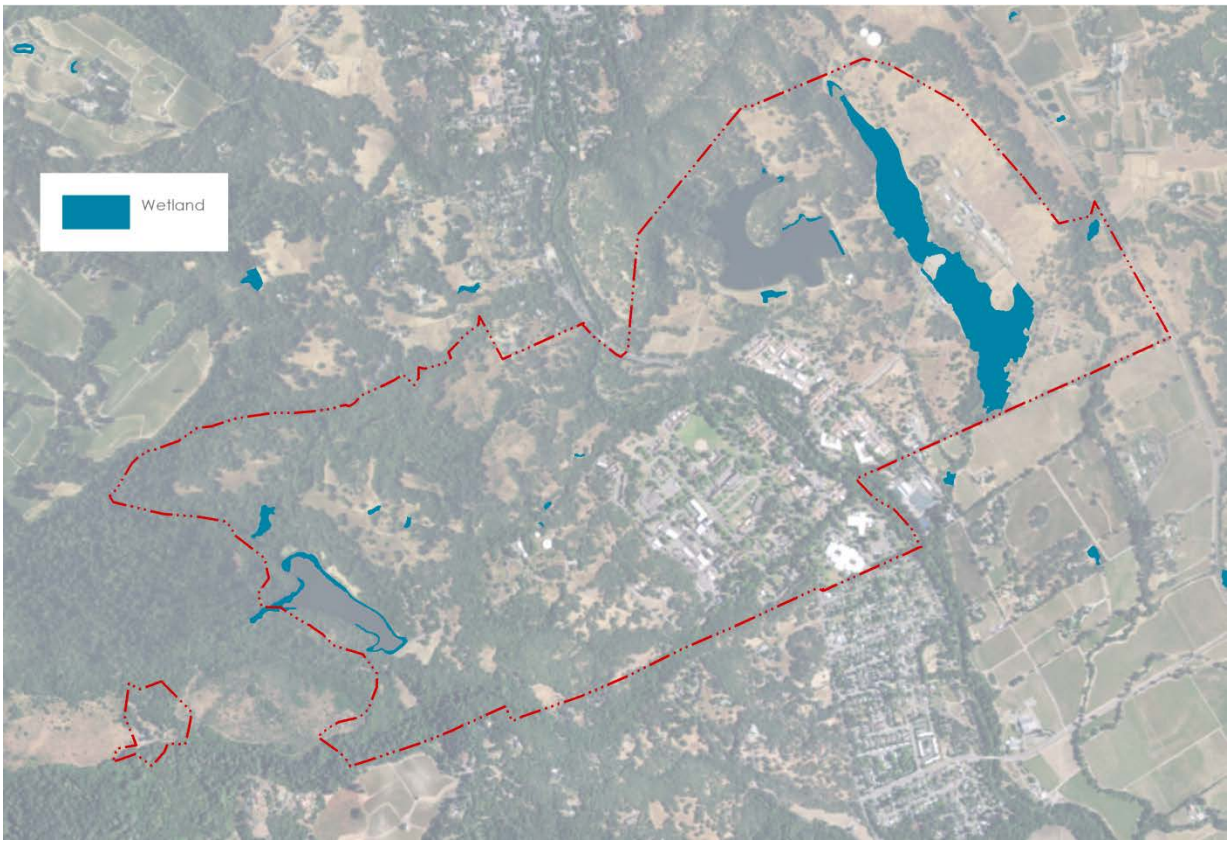


Figure 9. Distribution of wetlands at SDC and in vicinity. Roulette Springs wetland is just north of Fern Lake; its approximate full extent is shown here, but on other maps, most of this area is shown as redwood forest, which forms an overstory over the wetlands.

Wetlands

Wetlands occur in several locations on the property, occupying a total of approximately 30 acres. Aquatic and wetland vegetation is present in narrow bands along the shorelines of Fern Lake and Suttonfield Lake. A large seasonal wetland (which comprises most of the 30 wetland acres on the site) is present in the eastern grassland. Small, scattered seeps and swales support small seasonal wetlands elsewhere on the property, including along drainages, below the Fern Lake dam, and below the water treatment plant.

Along the lakeshores, emergent species including native tule rushes and cattails are common. At the edges of the water surface itself, native mosquito fern is present in some places. Barber et al. (2012) also noted submerged vegetation including invasive hydrilla, native common waterweed, and unknown species of water milfoil and pondweed. Adjacent to the seasonally fluctuating water's edge, wetland species adapted to shallower water and seasonal drying occur; these include both native and non-native species (including sneezeweed, water plantain, mugwort, knotweed, velvetgrass). A dense stand of invasive teasel is present at the north end of Fern Lake; invasive poison hemlock and Harding grass are also common.

In the eastern grassland, a large wet meadow is present below a small created pond. A grassy swale leads down from the pond onto the gentler terrain west of the agricultural buildings, where it becomes a

shallow, straightened channel, which may have been created or altered historically to improve drainage for agricultural use. This channel leads through a culvert under Sunrise Road. Downstream of Sunrise Road, the channel continues as a narrow ditch along the periphery of the meadow. Another drainage channel is present along the eastern edge of the meadow below Sunrise Road. See Figure 5, below. Soils in the wetland have concentrations of oxidized iron, a typical seasonal wetland indicator that results from extended periods of saturation.

Wetland fringe along Fern Lake.

Vegetation in the wet meadow is dominated by non-native species adapted to seasonally moist, marginal wetland conditions, including perennial grasses and forbs (e.g., Italian rye, Harding grass, poison hemlock, teasel) and Himalayan blackberry. In wetter areas near the center of the wetland, patches of native species that require more moisture are present, including patches of creeping wildrye, creeping spikerush, and basket sedge. Several mature arroyo and shining willows are present, which suggests the site may have been wetter in the past. There are also several young valley oaks present. The area is currently grazed lightly by horses. Based on the historical ecology study of Dawson et al. (2016), the wetland appears to have been present at the time of European settlement, in the mid-1800s, as well. The wet meadow area burned in the Nuns Fire of October 2017, but was already dense with new green growth by the time of PCI's November visit. The burn may have a limited effect on species composition in the meadow but is not expected to have significant long-term impacts unless debris or contaminated runoff from adjacent buildings is allowed to enter the wetlands.

Horses grazing in large wet meadow on east side of site.

Figure 5. Wet meadow on east side of SDC (outlined in green). Pond visible at upper left (upstream) end. Natural swale drains below pond, and then straightened channel and multiple drainage ditches (dashed blue lines) continue south.

Seep, swale and riparian wetlands on SDC are dominated by perennial herbaceous species adapted to seasonal to perennial moisture, including sedges, common rush, irisleaf rush, and common spikerush. In drier seeps and swales within grassy areas, non-native seasonal wetland species like pennyroyal and spinyfruit buttercup; native common meadowfoam was also present in some. The riparian wetlands occur in less disturbed settings, beneath forest canopy, and are generally dominated by native species. These include small patches of wetlands in relatively level areas along upper Asbury Creek, and more extensive, well-developed wetlands surrounding Roulette Springs. Sedges, horsetail, and ferns (swordfern, lady fern, wood fern, California polypody), are common in these riparian wetlands.

Riparian wetlands, upper Asbury Creek.

The Roulette Springs wetlands occupy approximately 0.8 acre in a gentle swale below Fern Lake in the upper watershed of Asbury Creek. (No formal jurisdictional delineation was performed; wetland boundaries were estimated based on vegetation and hydrology observations in the field in combination with existing aerial imagery and topographic data.) The wetlands occur mostly under the canopy of redwoods. These wetlands are fed by perennial springs and support stands of panicled bulrush, mugwort, knotweed and sneezeweed as well as the ferns and monocots found in the other riparian wetlands. Sapling bigleaf maples, bays, and redwoods as well as spicebush are present in some locations. Water from Roulette Springs is diverted for SDC use, and a network of water transport channels and other infrastructure is present. These diversions and channels may reduce the extent and development of the wetlands; further study would be needed to confirm and quantify these impacts.

Seep wetland northwest of central campus.

The habitat integrity of SDC's wetlands varies. The lower-lying wetlands are low in native species diversity and are heavily influenced (or created) by human land and water use, while upper riparian wetlands are smaller but less disturbed, and more diverse in terms of structure and composition. The hydrology and vegetation of the eastern wet

meadow is likely strongly influenced by the upstream impoundment, multiple drainage channels, and history of livestock use. The riparian wetlands along upper Asbury and Hill Creeks are small but less disturbed, and are high in native diversity and habitat value. The Roulette Springs wetlands are relatively large (compared to the other riparian wetlands), and are also high in native diversity and habitat value, despite ongoing water withdrawals and infrastructure.

While small seep wetlands are relatively common on undeveloped lands on the slopes of Sonoma Mountain, larger lower-lying wetlands are rare in the Glen Ellen area, where filling and leveling for agricultural uses have dramatically reduced their extent. Well-developed riparian wetland complexes like that of Roulette Springs are uncommon on the slopes of Sonoma Mountain.

Roulette Springs wetland.

Key ecosystem processes that shape SDC's wetlands include grazing, water flows, and climate change. Livestock grazing has shaped species composition in the wet meadow. The interaction of water inputs from rainfall, diversions, impoundments, drainage ditches, and drought stress from climate change affects the wetlands' extent and species composition.

Wetlands provide groundwater recharge, mitigate storm flows, and filter contaminants and sediments from runoff. Aquatic and wetland vegetation also provide wildlife habitat, protects soil from erosion. The reservoirs provide additional wildlife habitat, as well as serving as water storage for human needs.

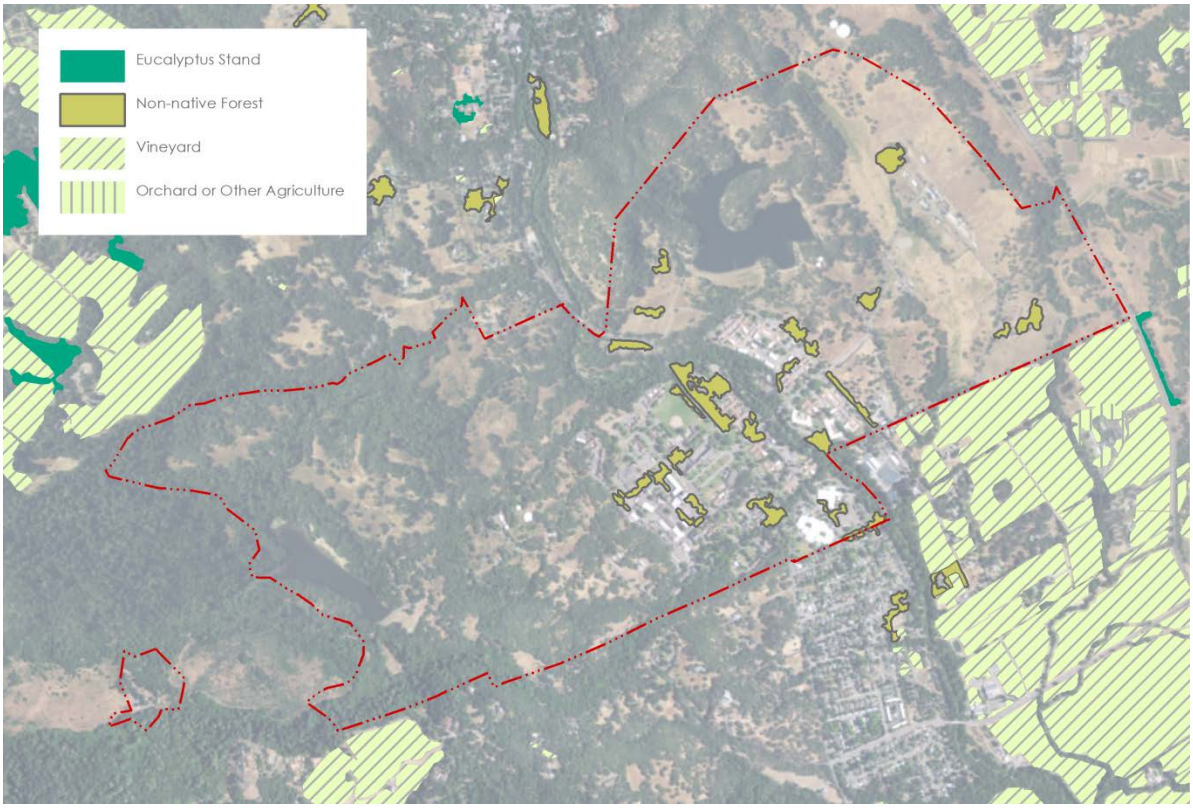


Figure 11. Non-native vegetation types, including remnant orchard, ornamental trees, and active agricultural plantings at SDC and in vicinity.

Ornamental Landscaping and Remnant Orchards

Within the central campus, there are many mature trees that have been planted for landscaping purposes which provide ecological benefits as well as shady, beautiful places for people to enjoy and an important component of the historic landscape. Large, spreading magnolias, tall sycamores lining the streets, palms and many other species provide wildlife habitat and shading of buildings. The variety, size, and beauty of the campus plantings are unusual for the Sonoma Valley, providing an almost arboretum-like character. Remnant native valley oaks are present on the southwestern portion of the central campus as well, and native riparian trees have been retained along the creek where it divides the campus. Remnant orchard plantings are present, including a grove of large walnuts on the southeast side of the property near the John Mesa fields, and a few old apricot trees behind (east of) the Camp Via buildings. Additional historic orchard is present just west of Camp Via, on what is now Jack London SHP, and Jack London Park Partners

Catalpa tree on core campus, one of many mature ornamental specimens that contribute beauty and shade to the campus.

is tending those trees (pruning deadwood, thinning fruit) to help prolong their lives.

Most of the landscape trees are situated within irrigated lawns, and probably benefit from that added water and/or have become reliant on it. SDC staff noted that tree dieback resulted when irrigation was cut back in response to recent drought, and a number of dead or stressed trees were apparent in summer 2017.

Native oaks line a swale through the central campus.

Remnant apricot orchard with coyote brush succession, behind (east of) Camp Via buildings.

Fish and Wildlife Resources

Sonoma County is one of the most biologically diverse regions in California. With its varied topography, geographic location, and proximity to the coastal habitats and baylands, it supports untold numbers of fish, amphibians, reptiles, mammals, birds, and insects. Each species plays a distinct role in the biotic community. These creatures include both familiar species that occur across the region and critically endangered ones with highly restricted ranges. The biological diversity of SDC reflects that of the county. It too provides the variety of habitats and microhabitats that so many of the county's animal species depend on. Habitats on the property offer both common and special-status animals nesting habitat, food, shelter, and water. The property is located at the core of the Sonoma Valley Wildlife Corridor, serving as an important movement corridor at both a local and regional scale.

The Sonoma Valley, including the lands of SDC, has undergone significant changes since European settlement in the early 1800s, including dramatic changes to its fish and wildlife populations. The valley once supported expansive wetlands, and intact forests and native grasslands, and was home to a large number of beavers, otters, tule elk, and grizzly bears (Barber et al., 2012). Today, fish and wildlife populations are just a remnant of what they once were, but SDC still supports a relative abundance and diversity of animals, based on documented occurrences and general habitat conditions that meet the needs of wildlife species within this region. The property itself is large and diverse enough to sustain some wildlife species through all of their life cycles. SDC is adjacent to other protected lands and undeveloped landscapes, so that wildlife can move onto it and through it relatively freely. The property provides key habitat for Sonoma County's top carnivores, including mountain lions and bobcats, which have large home ranges. SDC's expansive undeveloped lands also contribute to the genetic diversity that helps build resiliency in regional wildlife populations.

Sonoma County, in general, supports a large number of animal species—and a high percentage of these are known from SDC itself. There are 433 documented bird species in California; 421 of those have been reported in Sonoma County (Bolander and Parmeter 2000). SDC makes up only a small fraction of the land in Sonoma County (0.09%); however, it has been reported to support 129 species, 31% of the county-wide total (Appendix B). Similarly, there are 165 native bird species documented breeding in Sonoma County; 88 of these have possible or confirmed breeding occurrences in and surrounding SDC (USGS 2017) (Appendix C).

SDC supports documented or potential habitat for 12 species of amphibians (24% of the state's documented 51 species); 16 species of reptiles (19% of the state's 84 species); and 43 species of mammals (22% of the state's 197 species). Special-status California freshwater shrimp, northern spotted owl, foothill yellow-legged frog, California giant salamander, and steelhead are all known to occur on or adjacent to the property.

The following section describes the importance of SDC, the nearby lands, and their role in wildlife movement in the region. It describes the current local and regional studies that have been undertaken to better understand wildlife movement across the Sonoma Valley Wildlife Corridor and beyond. The habitat connectivity discussion is included first to provide an overview of the importance of SDC in supporting native wildlife species both on the property and beyond. Many of the studies presented are ongoing and, as a result, so is our understanding of local wildlife activity and movement patterns in the region. Following the Wildlife Habitat Connectivity section is a summary of the existing wildlife communities present at SDC based on the current habitat conditions.

Wildlife Habitat Connectivity

SDC is situated at the heart of the Sonoma Valley Wildlife Corridor, one of California's critical linkages for wildlife. The Corridor encompasses over 10,000 acres of land stretching from Sonoma Mountain east across Sonoma Valley to the Mayacamas Mountains (Exhibit 1a, 1b). It is a key linkage in a larger corridor from coastal Marin to eastern Napa County. With only half of the land comprising the Sonoma Valley Wildlife Corridor under permanent protection (i.e., approximately 5,700 acres of the 10,000 acre corridor) for natural resource conservation, much of the remaining land is subject to development pressure and the permeability and integrity of the Corridor is at risk (SLT 2014a). (Approximately 175 additional acres within the Corridor have conservation easements protecting intensive agricultural uses, including vineyard; these are not considered part of the protected Corridor since their wildlife permeability is generally lower). Development within the Corridor has potential to affect the long-term survival of local wildlife populations.

*A **wildlife corridor** is an area of habitat that allows wildlife to travel between larger blocks of habitat.*

These passageways allow animals to move as needed to find food or water, find mates, escape from predators, or find other resources needed for a particular life stage. These corridors are especially critical in landscapes altered by people; roads, buildings, and even agricultural lands can all stop or limit animals from travel.

Wildlife corridors also allow individuals to move and mix among nearby populations, which helps prevent the negative effects of inbreeding and reduced genetic diversity that often occur within isolated populations.

Beginning in the 1990s, the Sonoma Valley Wildlife Corridor began to be recognized as an area of significant wildlife presence and movement (SLT 2014a). Early efforts by SDC staff person Christy Vreeland and the Sonoma Ecology Center were successful at advocating for the inclusion of the property and surrounding lands as a crucial wildlife corridor (see text box) in the General Plan 2020 (Sonoma County 2008). The General Plan identifies the need to protect linkages and corridors to allow movement across the landscape and to connect wetland and other important habitat areas to undeveloped lands and permanent open space. The lands south of Glen Ellen connecting Sonoma Mountain and the Mayacamas Ranges, including SDC, were identified as an important linkage.

In 2011, the Bay Area Open Space Council completed the *Conservation Lands Network* (CLN), a five-year effort to identify a network of lands aimed at conserving key biodiversity targets within the nine-county Bay Area. The CLN recognized lands that are crucial for conserving biodiversity based on vegetation types, species, and riparian zones. It identified the Sonoma Valley Wildlife Corridor and Sonoma, Hill, and Asbury Creeks as key areas for conservation (Bay Area Open Space Council, 2011).

A more detailed analysis of the linkages identified in the CLN was completed by Science & Collaboration for Connected Wildlands (SC Wildlands). Their report, *Critical Linkages: The Bay Area and Beyond*, identifies areas that are vital for connectivity within the Bay Area and across the larger landscape to the north and south (Penrod et al. 2013). This includes 14 landscape connections designed to preserve landscape-level processes and maintain wildlife populations. Based on a least-cost corridor analysis (see text box next page) of 66 focal species with a range of habitats and movement requirements, the best potential routes were identified between targeted areas. The Sonoma Valley Wildlife Corridor, including SDC, was identified as part of the Blue Ridge – Marin Coast Linkage which connects lands surrounding

Lake Berryessa in Napa County with coastal habitats in Marin, and encompasses 227,370 acres of land (Exhibits 1a, 1b). The analysis concluded that this linkage was vital to mountain lion movement from Marin County to Sonoma Mountain and across the valley to the Mayacamas and Blue Ridge Mountains.

Figure 5. Location of Sonoma Developmental Center relative to regional wildlife corridors (Bay Area Open Space Council 2011).

Mayacamas Connectivity Report

A more localized study of the landscape connectivity within the Mayacamas region was funded by SCAPOSD and completed by Adina Merenlender and associates at UC Berkeley in 2010. The *Mayacamas Connectivity Report* generated and tested a landscape connectivity model to provide a basis for the conservation of habitat linkages with the greatest biological benefit and resiliency in the face of climate change. The work included developing a biologically informed structural habitat connectivity model that provides an estimate of the permeability of oak woodland habitat in the region in light of existing developed areas. The Sonoma Valley Wildlife Corridor was identified as a crucial pathway between Sonoma and the Mayacamas Mountains, as well as one that is threatened by ongoing development (Merenlender et al. 2010).

Least-cost corridor analysis *is a GIS technique that models the most efficient route for a species to travel between targeted areas based on how that species is affected by landscape characteristics like vegetation and topography.*

It is used to help identify the most effective places for wildlife corridors.

Sonoma Valley Wildlife Corridor Project

In 2013, Sonoma Land Trust initiated the multi-year Sonoma Valley Wildlife Corridor Project to ensure long-term sustenance of wildlife permeability through the Sonoma Valley and beyond. The goal of the project is to assess the permeability of the Corridor, develop a set of management and monitoring recommendations, and protect key

properties that provide critical wildlife passage features. Components of the larger project include the *Management and Monitoring* (Strategy) report (SLT 2014a) and *Sonoma Valley Wildlife Corridor Road Underpass Use Report* (2013-2014) (SLT 2014b).

The Strategy summarizes a background literature review, resource and permeability assessments, consultation with experts, installation of motion-activated cameras and continued monitoring of wildlife usage, and ongoing roadkill observations. It also identifies the qualities of effective corridors, primary limitations to corridors in the Sonoma Valley, and general land use practices for protecting wildlife permeability. The authors state that the most effective corridors have:

- High quality habitat,
- Varied composition and structure of vegetation with significant tree and shrub canopies, and dead and downed trees,
- Few barriers to movement, such as human infrastructure and activities, and
- Larger blocks of high quality habitat at either end.

The Strategy document identifies SDC as a critical path in the Corridor and states that permeability constraints here can have a significant detrimental impact on the function of the overall Corridor (SLT 2014a). While the SDC property was not formally assessed by the Corridor Technical Advisory Group, potential factors affecting wildlife use were identified that require further evaluation including "some aspects of recreation, such as quantity of visitors, presence of dogs, night versus day use." The Strategy did identify the permanent conservation of SDC as a means to ensure that protection of the larger Corridor. Key management guidelines identified in the Strategy that will be important for any future land use change on SDC include:

- Limit the construction of new roads
- Maintain crossing structures
- Limit fencing and use wildlife friendly designs
- Be fire safe and wildlife friendly—meet but do not exceed defensible space requirements for vegetation
- Do not allow pets to roam freely in wildlands
- Limit outdoor night lighting
- Incorporate native plantings and limit pesticide use

As part of the multi-year project, SLT established wildlife camera monitoring stations at eight locations[3] in the Sonoma Valley Wildlife Corridor including two on Sonoma Creek on SDC land (SLT 2014b). A goal of the camera monitoring was to determine whether undercrossings of Highway 12 and Arnold Drive are facilitating wildlife movement. Roads often serve as a significant impediment to wildlife movement, but where overpasses are present, wildlife can sometimes pass safely underneath. The camera monitoring was conducted over a 12-month period.

Wildlife photo captures were abundant and documented all species expected in the region other than a few reclusive mammalian species. The most frequently detected species on both SDC and all of the monitoring sites was the black-tailed deer (1,301 detections across all sites). Gray fox (574) had the second highest frequency of detections across the sites, followed by northern raccoon (267), domestic/feral cat (259), striped skunk (247), and non-native Virginia opossum (230). Bobcat (83) and

[3] These included two locations each on Calabazas, Hooker, Sonoma, and Stuart Creeks.

Black-tailed deer detected by motion-activated camera operated by SLT. Photo courtesy of SLT.

mountain lion (14) were detected the least frequently. A beaver was detected on Sonoma Creek and a porcupine was detected on Stuart Creek; very few porcupines have been reported in Sonoma County so this sighting is especially notable. Of particular concern is the high number of detections of domestic/feral cats on both SDC and Stuart Creek; cats can be extremely detrimental to native wildlife. The monitoring also revealed seasonal variations in wildlife movement. Peak detections were during the summer months (June-August) and fall, reflecting changes in wildlife movement throughout the year.

On SDC, there were a greater number of detections on the west side of Sonoma Creek than on the east side. On the west side, there were 957 animals detected. The highest rates of detection were black-tailed deer, gray fox, and northern raccoon. One beaver, one coyote, and two mountain lions were also detected. Other species included Virginia opossum, striped skunk, bobcat, and domestic/feral cat. There were 257 animals detected on the east side of Sonoma Creek. The highest rates of detection there were for black-tailed deer, northern raccoon, and gray fox. Less frequently detected species included domestic/feral cat, bobcat, Virginia opossum, and striped skunk.

In conclusion, SLT's work summarizes the importance of maintaining wide, well-vegetated corridors with minimal human intrusion. In an area with extensive agricultural, rural residential, and nearby urban development, there are many challenges for wildlife. Camera monitoring data shows high wildlife use in undercrossings as animals navigate through the valley. Protecting lands adjacent to undercrossings, controlling domesticated animals, and maintaining undercrossings both within SDC and across the Corridor will be critical for wildlife survival. A description of the wildlife crossings on SDC, with recommended permeability improvements and wildlife detections, is included in the Wildlife Corridors section below.

SDC Connectivity Analysis

Subsequent to the Strategy report, UC Berkeley researchers completed a connectivity analysis for Sonoma Land Trust with a specific emphasis on SDC (Gray and Merenlender 2015). Their research modeled the degree of wildlife permeability on the SDC property based on factors found to be important in previous studies of responses of carnivorous mammal and bird assemblages to human-modified land cover. These factors included distance to roads, habitat patch size, and parcel size.

Their modeling indicates that the northern portion of SDC has relatively high permeability (see Figure 6, below). Overall, 51% of the land supports permeability values ranging from 0.35 to 0.5, which the authors state is a range frequently used by wildlife such as mountain lions. Based on their work, the network of roads, especially Arnold Drive, and the high density of development in the center of the property, pose the greatest obstacles for movement through the property.

The Gray and Merenlender report also addresses the relative importance of SDC in the face of climate change. The authors found that the SDC corridor is likely to be particularly valuable in terms of access to cooler areas, slower rates of change, and greater climatic diversity compared to other similarly sized linkages in the North Bay. These results highlight the importance of maintaining connectivity for wildlife and providing them with the greatest opportunity to respond to a changing environment.

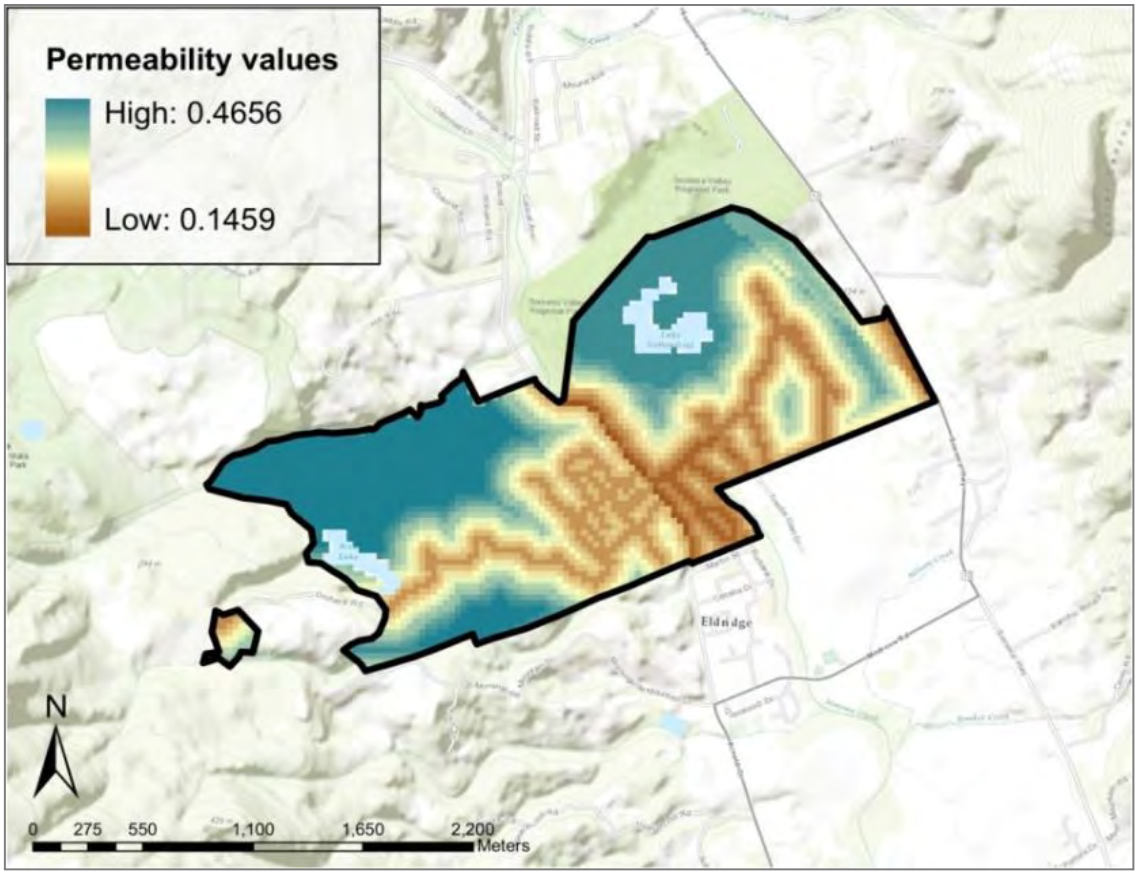


Figure 6. Landscape Permeability Values for SDC. From Gray and Merenlender (2015). A value of 1 indicates a high level of permeability, indicating that wildlife can move easily from one area to another. A value 0.0 indicates low permeability and restricted movement.

Audubon Canyon Ranch Mountain Lion Project

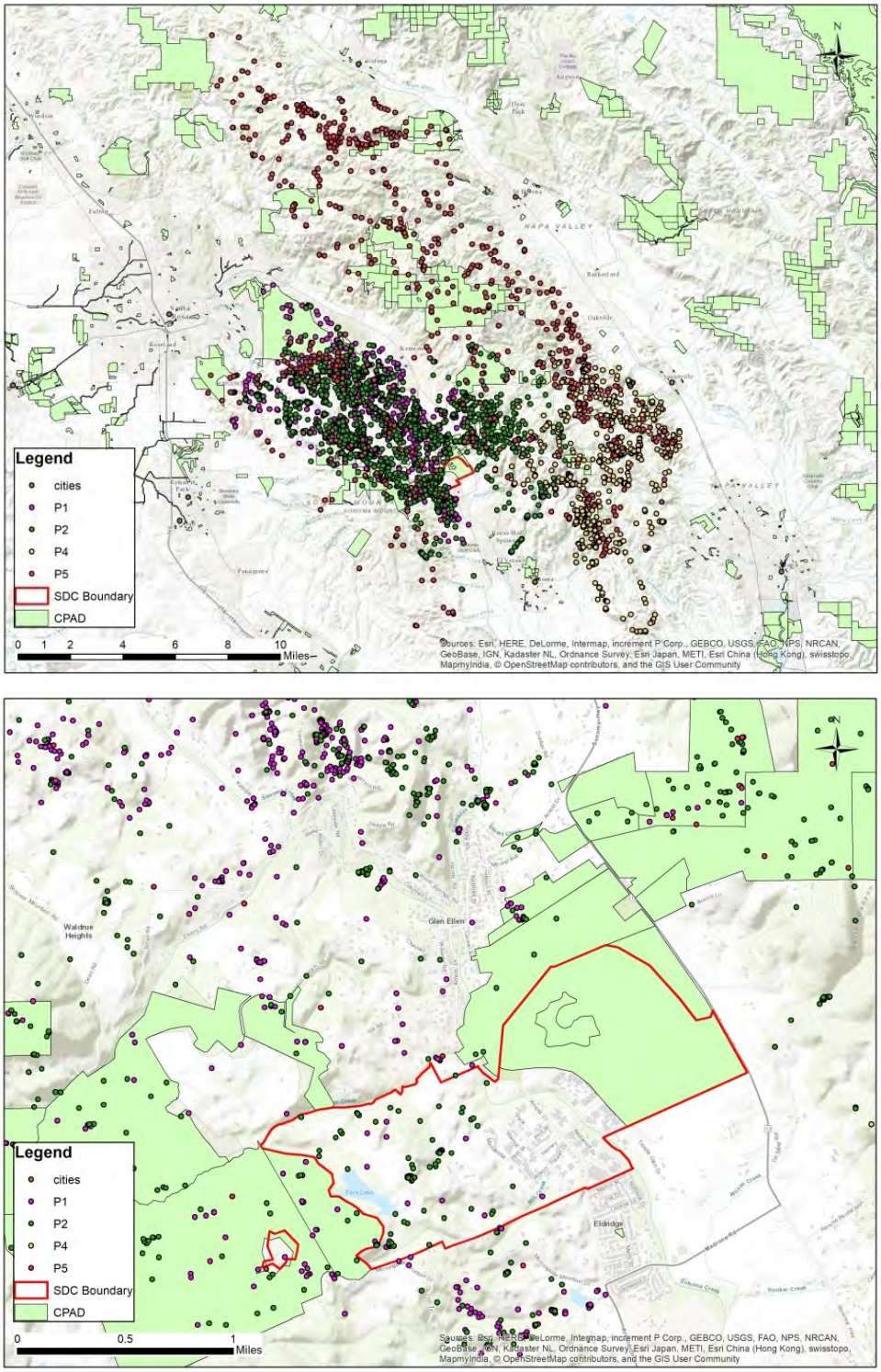
Audubon Canyon Ranch (ACR) has recently undertaken a community-based research and education project, ACR Mountain Lion Project, to expand the understanding of mountain lions in the Mayacamas Mountains and extending into Sonoma Mountain and SDC lands. Dr. Quinton Martins, an expert on large mountain cats, is overseeing the project. Movements of mountain lions fitted with GPS collars are being tracked over a study area encompassing approximately 1,000 square miles in Sonoma and Napa counties. The goal of the project is to understand the behavior, population size, feeding habits, home range, and movements of this top predator. The results of the project will provide valuable information on priority habitats areas for conservation and use of the Sonoma Valley Wildlife Corridor.

Currently, ACR is actively tracking four lions in the Sonoma Valley area – one adult female (P1), a female offspring of P1 (P2), a male with overlapping territory (P5), and a female near Sonoma (P4) with two cubs (not collared). Satellite positions of the mountain lions are collected every two hours. The current data collection methods allow ACR to track the general movement of lions and resting points (e.g., multiple data points at the same location for several hours). The lions are not detectable in locations with poor satellite coverage (e.g., dense cover or canyons with poor reception).

Figures 7 and 8 below show mountain lion movement patterns during a portion of the monitoring period. Preliminary data show that P1 wanders extensively along the east side of Sonoma Mountain from Annadel State Park to Boyes Hot Springs; she occasionally crosses over Highway 12 to the east side of the Sonoma Valley near Bouverie Preserve. P2 moves along the same corridor, but has been documented crossing the valley more frequently, and most likely utilizes Stuart Creek bridge under Highway 12 (SLT 2014b), north of SDC, or crosses directly over Highway 12. Dr. Martins states that Arnold Drive and Highway 12 are not currently significant barriers to mountain lion movement across the valley (Martins 2017). However, Highway 12 appears to function as the eastern boundary of P1's territory. P5, the male whose territory overlaps with the resident females, ranges on both sides of the valley. He has been documented along the Mayacamas Mountains, from as far north as Windsor and south near Sonoma, and throughout Sonoma Mountain. P4 occurs almost exclusively in the Mayacamas from Sonoma north towards Oakville, in Napa County. Based on preliminary data by ACR, SDC is used primarily by P1 and P2 with occasional visits from P5. Most of the lion detections on SDC are limited to the west side of Arnold Drive, in areas with some canopy cover. No detections have been made on the east side near Suttonfield Lake, but PCI noted the presence of mountain lion scat during a field survey of this area, and not all movements are recorded by ACR given the current data collection methods.

Based on ACR's observations, the primary limitation for mountain lion use of the SDC area is the extent of developed land and loss of natural vegetation, rather than roads as specific movement obstacles. Martins noted that lions readily cross smaller roads and easily jump most fences. However, he identified fencing as a key concern for other wildlife in the area. He suggested that preserving native habitat, maintaining low (25 mph or less) speed limits, and reducing fencing would be key elements of mountain lion protection in planning for SDC's future. He also noted that mountain lions prefer to avoid humans and are highly sensitive to human voices; recent research indicates that lions will, for example, leave a kill when they hear human voices. This, in turn, results in lions compensating by killing more prey like deer in areas with high human activity (Smith et al. 2017). Based on these findings, increased human presence on SDC could alter mountain lion foraging behavior and activity patterns.

Female mountain lion (P1) whose range centers on SDC (above) and male mountain lion (P5) whose range overlaps and includes SDC. Photos courtesy of Audubon Canyon Ranch.



Figures 7 and 8. Data courtesy of Audubon Canyon Ranch. Mountain lion movement patterns, October 2016 through August 2017. Figure 7 (top) shows regional movement throughout Sonoma Valley and to the north. Figure 8 shows movement near SDC. P1 = pink (adult female), P2 = green (female offspring of P1), P4 = yellow (adult female with two un-collared cubs), and P5 = red (adult male with overlapping territory).

Wildlife Crossings

To supplement the work completed by SLT (SLT 2014a and 2014b), PCI reviewed the undercrossings (culverts and bridge underpasses) of major roads on the SDC site to assess their potential to facilitate wildlife movement. Below are photos of the crossings, a summary of conditions, wildlife observed to have used the crossings, and suggestions for potential enhancements. See Exhibit 6 for crossing locations by number.

Crossing 1. North Butler Canyon Creek/ Highway 12

- Type/Dimensions: Very old bridge, 4’ high x 8’ wide
- Documented Wildlife Use: Northern western pond turtle, California quail, northern raccoon
- Notes/Recommendations: Also adjacent to Sonoma Valley Regional Park (SVRP) and Oak Hill Farm. Remove dense blackberry thicket and plant with more suitable native species. SLT is working in collaboration with SCWA, SDC, and Oak Hill Farm to clear blackberry and improve.

Blackberry thicket at North Butler Canyon Creek crossing.

Crossing 2. South Butler Canyon Creek/ Highway 12

- Type/Dimensions: Culvert, 5’ high x 6’ wide
- Documented Wildlife Use: Banana slug, black-tailed deer, gray fox, bobcat, possible river otter
- Notes/Recommendations: Also adjacent to Oak Hill Farm. Open and appears to be good crossing for medium-sized animals. Add native plantings adjacent to the culvert to improve cover.

South Butler Canyon Creek crossing; note banana slug crossing at bottom right

Crossing 3. Unnamed Butler Canyon Creek/ Highway 12

- Type/Dimensions: Culvert, 12” diameter.
- Documented Wildlife Use: n/a
- Notes/Recommendations: Adjacent to Oak Hill Farm. Enlarge, add native plantings; SLT is working in collaboration with Caltrans to improve this crossing in conjunction with proposed Highway 12 widening.

Unnamed Butler Canyon Creek crossing post fire in November 2017

Crossing 4. North Sonoma Creek/ Arnold Drive

- Type/Dimensions: Bridge, 15’ high x 40’ wide
- Documented Wildlife Use: beaver (dam present in past), bobcat, coyote, black-tailed deer, gray fox, mountain lion, northern raccoon, striped skunk
- Notes/Recommendations: Adjacent to SVRP. Underpass is bifurcated by a wall, creating two bays. 2’-3’ deep pool adjacent, and dense vegetation along banks; passage is impeded. Homeless encampment present. Remove blackberry and revegetate for improved overstory.

Looking upstream at North Sonoma Creek crossing

Crossing 5. South Sonoma Creek/ Arnold Drive

- Type/Dimensions: Bridge, 20’ high x 60’ wide
- Documented Wildlife Use: Bobcat, black-tailed deer, gray fox, northern raccoon, striped skunk
- Notes/Recommendations: No improvements needed; excellent passage opportunities. Tracks of multiple species observed.

Looking downstream at South Sonoma Creek crossing

Crossing 6. Sonoma Creek/ Harney Drive

- Type/Dimensions: Bridge, unknown dimensions
- Documented Wildlife Use: n/a
- Notes/Recommendations: Underpass bifurcated by support, creating two bays. Routine maintenance needed to clear debris jams. Left bank is a steep concrete bag wall, but upper flood plain on right bank may allow wildlife passage during higher flows.

Looking downstream at Sonoma Creek crossing at Harney Drive

Crossing 7. Hill Creek/ Arnold Drive

- Type/Dimensions: Box culvert, 5’ high by 8’ wide
- Documented Wildlife Use: n/a
- Notes/Recommendations: No improvements needed. Narrow riparian corridor in this location may limit wildlife use.

Looking upstream (left) and downstream (right) at Hill Creek at Arnold Drive crossing

Crossing 8. Hill Creek/ Redwood Drive:
Type/Dimensions: Culvert, 8’ high x 6’ wide (each of 2 bays)
Notes/Recommendations: Two bay culvert. Drop off from concrete sill poses passage barrier for fish and other aquatic species. See also Fish Passage Barriers section below. Narrow riparian corridor in this location also likely to limit wildlife use.

Looking downstream (above) and upstream (below) at Hill Creek and Redwood Drive crossing.

Fencing

The property also includes many perimeter and cross fences that restrict wildlife movement. Much of this fencing also poses a danger to wildlife that try to cross. Fences across key movement areas and near water sources are of particular concern. Removal of unnecessary interior and perimeter fencing, and replacement of required perimeter fencing with wildlife friendly materials as appropriate (Hanophy 2009) would improve wildlife permeability. See Exhibits 7a-d for general locations of fencing to be removed.

Strands of barbed wire between oak trees above Suttonfield Lake.

Wildlife Communities

The following discussion includes a general summary of wildlife typically associated with each documented habitat on SDC based on regional occurrence information, background studies, PCI field surveys, and reported observations. Wildlife communities are described relative to their primary habitas: forests and woodlands, grasslands, riparian habitats, reservoirs, wetland and ponds, and developed areas. Life history information and local occurrence information for special-status animal species are described in the following section. For a complete list of all wildlife species observed or potentially occurring on SDC, including scientific names, see Appendices B and C.

Forests and Woodlands

Forests and woodlands provide the greatest habitat diversity on SDC and support terrestrial birds,

mammals, amphibians, reptiles, and a variety of invertebrates. The forests and woodlands range from the dense shady redwood groves on the east-facing slopes and drainages of Sonoma Mountain to the mixed oak woodlands scattered throughout the property. Birds represent the most abundant and prominent wildlife species within these habitats. Year-round resident birds documented in SDC's woodland and forest habitats include chestnut-backed chickadee, western-scrub jay, American robin, common bushtit, oak titmouse, Bewick's wren, California quail, dark-eyed junco, and spotted towhee. Migratory species observed and breeding within the property include orange-crowned warbler, Pacific-slope and ash-throated flycatchers, and swallows.

California towhee in oak woodland habitat.

Tree-climbing birds such as woodpeckers, nuthatches, and brown creeper also frequent the property. Year-round residents include acorn, Nuttall's, hairy, and downy woodpeckers. Casual winter residents include red-breasted sapsucker (see photo), ruby-crowned kinglet, varied thrush, and Townsend's and yellow-rumped warblers. The dense fir and redwood patches are also key habitat for Sonoma County's largest woodpecker, the pileated woodpecker. Pileated woodpeckers can be heard frequently in the redwood-dominated drainages along Hill and Asbury Creeks—this is likely a pair of birds defending their territory, which they tend to do year-round.

Suitable foraging and breeding habitat also exists on the property for raptors. Red-tailed, red-shouldered, and Cooper's hawks have all been confirmed nesting nearby. Falcons, including American kestrel, frequent

the area as well. Cooper's and sharp-shinned hawks, uncommon forest and woodland hawks, use the site especially in winter when they are more readily observed. Small vertebrates within the habitats serve as a food source for predatory hawks and falcons. The larger oak, fir, and redwood trees are prime habitat for nesting raptors. The large mature trees on the site provide excellent raptor nesting habitat.

Mature redwood and Douglas-fir habitats are likely to support special-status northern spotted owl given the close proximity to established territories and the large territory size of this species. There are documented territories just outside of the SDC property boundary on Jack London SHP and private lands (Evens 2009), and LSA (2001) documented three owls in the redwood habitat along Asbury Creek in June 2000. Further focused surveys for northern spotted owl within SDC are warranted to determine current habitat use and evaluate potential impacts of land use changes on this species. Dusky-footed woodrats are the preferred food source for spotted owls and occur within the understory of SDC's woodlands.

Red-breasted sapsucker (woodpecker) feeding holes around oak tree on SDC; wells are excavated and sap allowed to accumulate for feeding.

Of particular concern for the northern spotted owl is the recent establishment of barred owl in Sonoma County, a species native to eastern North America, but one that has been expanding its range westward. It is unclear whether this range expansion is a natural phenomenon, human-caused, or a combination of both. Barred owls are larger and more aggressive than spotted owls and can displace, disrupt nesting of, and compete directly with spotted owls. Careful monitoring for, and, if needed, management of, the barred owl at SDC will be important to protect local northern spotted owl populations. Additional native owl species documented within SDC and nearby include barn owl, western screech-owl, great horned owl, and northern pygmy owl.

The woodland and forested habitats of SDC support a variety of mammals. Undisturbed habitats with limited human activity provide escape, cover, migration corridors, and nesting sites for a number of larger mammals. SLT has documented the occurrence of several mammal species in high numbers and on a routine basis via camera monitoring; these include black-tailed deer, raccoon, and gray fox (see Wildlife Habitat Connectivity above). All of Sonoma County's top predators - mountain lion, bobcat, and coyote

have been documented on SDC as well (SLT 2014b). Many of these mammals use the existing trail and road network outside the core campus extensively; bobcat and gray fox scat was found throughout the property and mountain lion scat was observed near a deer carcass east of the John Mesa field. Native black bears are occasionally reported in the Sonoma Valley; a black bear was spotted on Hood Mountain in August 2017 by Regional Parks. However, black bears are fairly uncommon and not expected on SDC with any regularity. California ground squirrels are abundant on the property, especially at the edge of developed areas, and were documented at Camp Via and John Mesa Field. The diversity of forested and wooded habitats on SDC and their proximity to aquatic habitats also provides excellent foraging and roosting habitat for bats, including several special-status species.

Native oaks and oak communities found within the property serve as a significant resource for many wildlife species in the form of both food and shelter. Every part of the oak tree is utilized as forage for native species including acorns, leaves, twigs, pollen, roots, and sap. Perhaps the most widely recognized source of food is the acorn. This high-energy food is used heavily by acorn woodpeckers, western-scrub jays, and western gray squirrels. Individual trees are also important food storage sites for acorn woodpeckers, which cache acorns for future consumption, particularly in dead and dying oak trees. Many acorn caches occur throughout SDC. The use of acorns by a number of wildlife species is important for oak dispersal and regeneration. The entirety of an oak tree, from canopy to roots, also serves as shelter for wildlife. Even the layer of detritus around the base of an oak is utilized by amphibians and insects.

Acorn woodpecker and acorn granary in SDC's woodlands.

On the woodland and forest floor, woody debris piles and layers of duff provide habitat for amphibians. Locally common amphibians including Ensatina, California slender salamander, and arboreal salamander are likely to occur on SDC. Common reptiles of this community include Skilton's skink, fence lizard, alligator lizard, common kingsnake, rubber boa, gopher snake, rattlesnake, and ring-necked snake. SDC also supports habitat for a variety of native butterflies, other beneficial pollinators, and additional invertebrates. Banana slugs are common; a group of slugs were found burrowed into a damp bank along the Butler Canyon Creek. One slug crossed through the Highway 12 underpass (see photo below).

Banana slug traveling through South Butler Canyon Creek underpass.

Grasslands

Grasslands provide habitat for a range of wildlife species. They provide cover for species such as birds, small mammals, and reptiles, and provide a food source in the form of seeds, other plant parts, and insects. Oak trees scattered throughout the grasslands on SDC provide key habitat for birds and other wildlife; the value of oaks trees is discussed in the Forests and Woodlands section. Many of the grasslands on SDC are also interspersed with coyote brush. These shrubby patches increase habitat complexity of the grasslands, providing additional perching, foraging, and nesting opportunities.

Grassland songbirds, including grasshopper sparrow, rufous-crowned sparrow, savannah sparrow and western meadowlark, use the property for nesting as all of these species have been seen nearby during

the breeding season. Other representative grassland species such as the western bluebird, loggerhead shrike, and Say's phoebe utilize grasslands, especially when there are adequate perches to forage from. Predatory hawks and owls, including American kestrel, white-tailed kite, and barn owls, frequent these areas as well. Red-shouldered hawks are frequently seen flying from the woodlands areas to grasslands in search of food. Small vertebrates and invertebrates within the grasslands are a key food source predatory birds.

Black-tailed jackrabbit at woodland edge.

Subterranean foragers, such as Botta's pocket gopher and California mole, commonly occur in grassland habitats. Underground digging and mounds and small wildlife tunnels can be seen throughout the property and are clear indicators of the presence of subterranean wildlife and small mice and voles. Scattered oak trees and coyote brush provide additional browsing and protective cover for wildlife. Black-tailed jackrabbit (see photo) occur along the grassland edges and eat twigs, evergreen leaves, and bark from plants. Shrubs are important to many other mammals (e.g., bobcat, gray fox) as shade during hot weather. Reptiles of this community include western fence lizard, alligator lizard, western skink, and snakes. Bats also forage over grasslands. Seasonal wetlands mixed within the grasslands add to the habitat complexity, providing additional foraging and nesting opportunities (see Wetlands and Ponds below). Buckeye butterflies are frequently seen in the grassland on SDC.

Western fence lizard in open grassland habitat

Riparian Habitats

SDC encompasses three main stream channels and multiple smaller drainages with associated riparian habitat. Sonoma Creek bisects the property, and Asbury and Hill Creeks form the northern and southern property boundaries, respectively. Butler Canyon Creek crosses the eastern edge of the property. Two freshwater reservoirs (Fern Lake and Suttonfield Reservoir), ponds, and seasonal wetland habitat are also present (see following sections).

A number of background studies have been completed within the Sonoma Creek watershed and its tributaries to document instream and riparian habitat conditions and aquatic resources. CDFW protocol-level inventories of mainstem Sonoma and Asbury Creeks were completed by Southern Sonoma County Resource Conservation District in 1996 (SSCRCD 1996). These inventories document the availability of instream habitat and aquatic resources. Robert Leidy of the U.S. Environmental Protection Agency has prepared several regional documents outlining fish surveys and stream conditions in the San Francisco Estuary, including Sonoma Creek and its tributaries (Leidy, et al. 2005; Leidy 2008). Aquatic species presence and instream conditions were also evaluated as part of the LSA (2001) study, and more recently for the *Watershed Sanitary Survey* which included SDC lands (Barber et al. 2012). An inventory of fish barriers within the watershed was completed in 2003-2004 (Katopothis et al. 2005). For the current effort,

PCI surveyed the length of Sonoma Creek running through the property and representative habitats on Hill and Asbury Creeks.

Riparian habitats tend to have an exceptionally high value for both aquatic and terrestrial animals. In general, riparian habitats and stream channels provide nesting opportunities, food, and shelter, and may serve as corridors or refugia during migration for a variety of fish and wildlife species. Riparian vegetation provides foraging and nesting opportunities for both migrant and resident birds. A number of bird species are closely tied to the creek itself. Herons and egrets forage for fish and other vertebrates in shallow waters, along with the fish-eating belted kingfisher. Birds like the black phoebe are seen sallying over water sources for aerial insects, and dabbling ducks such as mallards and wood ducks are frequently observed foraging within stream channels. Bird species occurring both along riparian corridors and in adjacent uplands on SDC include red-shouldered hawk, California quail, mourning dove, great horned owl, Anna's and Allen's hummingbirds, downy and hairy woodpeckers, western wood-pewee, Pacific-slope flycatcher, tree swallow, Steller's and western-scrub jays, chestnut-backed chickadee, bushtit, Bewick's wren, Swainson's thrush, American robin, wrentit, warbling vireo, orange-crowned, yellow and Wilson's warblers, black-headed grosbeak, spotted towhee, song sparrow, purple finch, and American goldfinch. All of these species have confirmed occurrences on SDC.

Aquatic salamanders, including newts and giant salamanders, utilize stream channels during the wet winter months, and terrestrial species (e.g., slender salamander, Ensatina) inhabit the adjacent woodlands. California giant salamander, a special-status species, has been documented in Asbury Creek (SSRCD 1996) and suitable habitat is also present in Sonoma and Hill Creeks. Sonoma and Hill Creeks support healthy populations of western toad; toadlets were abundant during summer surveys of mainstem Sonoma Creek and at small wetland seeps on Hill Creek, where froglets of Sierran treefrog were also abundant. A single adult foothill yellow-legged frog was observed in Asbury Creek in July 2017; this is a new occurrence for this species in the watershed. California red-legged frogs occur within the Sonoma Mountain watershed and upslope of SDC on nearby SCAPOSD-owned properties (PCI 2012) but have not been confirmed on SDC. The most common reptiles of riparian habitats are the northern western pond turtle and aquatic garter snake; western rattlesnake have also been documented in the riparian habitats on SDC (see photo).

Rattlesnake on Sonoma Creek.

Western pond turtles have been observed at the north Butler Canyon Creek crossing under Highway 12 (Nelson 2017).

Mammals documented in SDC's riparian habitats include western gray squirrel, dusky-footed woodrat, northern raccoon, gray fox, and black-tailed deer (see discussion about beavers below in the Sonoma Creek section). In addition, common bat species may forage over stream channels and adjacent woodlands and roost within the larger trees. The stream channels themselves are an important habitat for a variety of aquatic organisms that serve as the food base for larger aquatic and terrestrial species. Native butterflies frequently observed along the riparian corridors on SDC include Lorquin's admiral and western tiger swallowtail. Dragonflies are prolific. Fisheries resources and other aquatic species are described below for the individual watersheds. Riparian habitats act as key migration corridors at both a local and regional scale.

Sonoma Creek

In comparison with other Bay Area drainages, the Sonoma Creek watershed provides an ecological refuge for a large number of sensitive species (SEC 2006). The watershed is also considered one of the most essential steelhead resources of the San Francisco Estuary (Becker et al. 2007). The Sonoma Creek reach within SDC is a small component of the larger stream system, but it represents vital habitat and a key connection through the watershed (see also Hydrology and Geomorphology section).

Sonoma Creek, where it flows through SDC, is a fairly low-gradient channel. It enters the property after crossing under Arnold Drive near Sonoma Valley Regional Park. After a sharp bend, it crosses back under Arnold Drive, turns to the southeast, and then flows through a relatively straight channel for the remainder of the property. The SDC reach of Sonoma Creek is generally wide, low-gradient riffle run habitat. Flows are perennial and the creek supports many diverse habitat features. The substrate is comprised primarily of cobble and gravel, with finer sediment found in low velocity zones. Boulders protrude from the channel bed in some sections. Alternate and mid-channel bars are present, and small debris jams are commonly found at the apex of the bars. Overflow channels are present in multiple locations where the channel is wide. Sedge beds grow on and along the bars, providing shade over the water and instream channel complexity. Sections of stream bank are undercut beneath alder rootwads, providing shelter habitat during high flows. Several sections of the creek banks have been stabilized with concrete rubble, shotcrete, and concrete bags or are actively eroding with steep vertical banks (see Exhibit 7c). These active erosion areas and bank repair areas diminish habitat values. Riparian vegetation is generally well-established along the length of Sonoma Creek. Canopy cover is formed by relatively tall trees, creating an open channel. Sections of the creek have limited canopy and the channel is directly exposed to sunlight. Riparian understory vegetation is dense along the banks and includes both native and non-native species; see Plant Communities above.

Open channel under a canopy of alder on Sonoma Creek.

Schools of California roach at debris jam at Harney Drive.

Sonoma Creek through SDC has three road crossings: Harney Drive and north and south Sonoma Creek at Arnold Drive (see Wildlife Crossings section above for details and photos). These crossings support natural channel bottoms and passage is not restricted; however, the crossings at Harney Drive and north Sonoma Creek are bifurcated and woody debris may accumulate on the supports. At SDC's water intake on mainstem Sonoma Creek, there are two concrete sills spanning the channel. The downstream sill has been notched for improved passage, but the upstream sill is not and has a several inch lip at summer base flows. These structures may restrict fish passage, especially for juvenile salmonids under lower flow conditions; see Fish Passage Barriers section below for details.

Within Sonoma County, mainstem Sonoma Creek and several of its tributaries have the highest priority ranking based on the availability of remaining steelhead habitat, the most immediate needs for restoration, and potential for habitat restoration (Becker et al. 2007, Penrod et al. 2013). Historically, the Sonoma Creek watershed supported the second largest steelhead run among Bay Area streams (Becker et al. 2007). Today, the mainstem and a number of tributaries still support notable runs of steelhead. However, steelhead production in the watershed is limited by the availability of suitable spawning habitat, availability of summer water, fish passage barriers, sedimentation, and water temperatures (SEC 2006). A few young-of-the-year steelhead were documented in the upstream reaches of Sonoma Creek in summer 2017.

In addition to steelhead, small numbers of adult Chinook salmon are frequently reported in the watershed; however, they are believed to be strays from the neighboring Napa River and not a self-sustaining run. The creek is also known to support California roach, threespine stickleback, Pacific lamprey, Sacramento pikeminnow, Sacramento sucker, prickly sculpin, and riffle sculpin (Cox 2014, Penrod et al. 2013). Large schools of California roach were seen in summer 2017; see photo.

In addition to fisheries resources, the SDC reach of Sonoma Creek provides important habitat for a number of other aquatic species. The reach is known to support a fairly robust population of California freshwater shrimp, a federally and State endangered crustacean, with habitat conditions ranging from suitable to marginal (Cox 2014). Sonoma Creek throughout SDC provides undercut banks with overhanging willows, suitable for shrimp foraging and high refuge habitat. Freshwater shrimp are endemic to three California counties—Napa, Sonoma, and Marin—and four drainage systems within those counties. Sonoma Creek and Napa River form one of these four drainages (USFWS 1998).

Sonoma Creek supports a small population of beavers. After being exterminated from the watershed in the mid-1900s due to the California Fur Rush, beavers returned in 1996 only to be trapped and killed once more after destroying merlot grapevines in a creekside vineyard. Community uproar and a shift in attitude ensued. Beavers have since returned, and now, sightings are common near Sonoma and Glen Ellen. On the SDC property, beaver dams and scat are frequently seen along the creek (Barber et al. 2012, Nelson 2015). Sonoma Creek and its tributaries also support river otter; river otter scat is abundant along Sonoma Creek through SDC.

Hill Creek

Hill Creek is a tributary to Sonoma Creek at the south end of SDC. The drainage originates on the eastern slopes of Sonoma Mountain and flows through a steep forested canyon as it meanders through SDC and the adjacent properties. The channel straightens through the core campus before draining to Sonoma Creek. Fisheries resources within Hill Creek are limited. Katopothis et al. (2005) identified two complete fish passage barriers within the watershed, resulting in the loss of 100% of available habitat. (See Fish Passage Barriers section below for photos and further discussion.) The barriers are described as box concrete culverts at Arnold Drive and Redwood Drive. However, based on PCI's 2017 assessment, the Arnold Drive crossing does not appear to be a barrier for fish; the culvert has a natural bottom channel with no apparent obstructions. The Redwood Drive crossing is a double bay box culvert with a significant drop between the culvert bottom and the downstream pool; there is perched concrete sill at the downstream end of the culvert and a 4-foot drop to the pool substrate. This crossing is likely a significant barrier to fish and other aquatic life, especially juvenile fish. Just upstream of Arnold Drive, there is an old rocked wall and eroded pipes at the pedestrian footbridge over Hill Creek in the core campus area that pose a hazard or impediment to passage. Upstream of the core campus, the upper reaches of Hill Creek include several instream barriers as well. Removal or modification of these barriers would allow for greater fish and wildlife utilization within the watershed. A flashboard dam is installed each winter on Hill Creek as part of SDC's water intake system; this restricts movement seasonally up- and downstream of the diversion structure.

In 2007, steelhead of unknown life stage were documented in Hill Creek 100 feet downstream of the road crossing at Arnold Drive on SDC (Leidy et al. 2005). SEC reported seeing a small number of steelhead young-of-the-year and one-year and older fish, at an unreported location (Leidy et al. 2005). California roach and sculpin have been documented in the watershed (Leidy 2008). PCI did not observe any fish

during surveys in summer 2017, but the creek flows perennially and supports pools and shallow riffles that are potentially suitable for spawning. Based on SEC (2007), Hill Creek supports high quality steelhead habitat in the upper watershed, with suitable wood and canopy coverage, but limited aquatic life. The creek experiences high sediment loads and has documented fish barriers, which may limit fish within the watershed. It is possible that with the removal of the instream barriers and addressing the sediment issues, the watershed could support a small population of steelhead. Suitable habitat is also present for other native fish and wildlife, including special-status foothill yellow-legged frog and California giant salamander, which occur in nearby Asbury Creek.

Instream habitat conditions on Hill Creek.

Asbury Creek

Asbury Creek is a tributary to Sonoma Creek to the north of SDC; the creek runs along the northern property boundary, winding in and out of the SDC property. The drainage originates on the eastern slopes of Sonoma Mountain and flows through a steep forested canyon before reaching Sonoma Creek. Asbury Creek has several structures that may restrict passage in the watershed. A concrete flume located immediately upstream of the Sonoma Creek confluence is reported to restrict passage during high flows, outside of the SDC property (SSRCS 1996). SDC installs a flashboard dam each winter as part of their water intake system. The dam is a seasonal barrier restricting movement up- and downstream during the diversion season (October through May). Both Katopothis et al. (2005) and SSCRCD (1996) describe this

as a partial fish barrier. Repairs to the diversion structure were completed in 2006 and it currently operates under guidelines from NOAA Fisheries Service per SDC staff.

Dawson (2005), citing California Department of Fish and Game (now CDFW) stream surveys, notes that Asbury Creek historically supported a population of steelhead. From the early 1900s until the 1970s, Asbury Creek was a popular fishing location and evidence of steelhead spawning was documented. A severe decline (70-99%) in the population was noted in the 1960s-1970s. Between 1974-1977, no steelhead were documented in the watershed based on CDFW survey data. Dawson (2005) notes a possible cause for the decline was the culvert at Arnold Drive.

In 1996, SSCRCD and CDFW completed a survey of Asbury Creek from the confluence to the diversion structure on SDC (SSCRCD 1996). They noted six steelhead below the diversion structure; five one-year-old fish and one young-of-the-year. The survey was terminated at the diversion structure, but the team completed a visual survey for another 0.5 mile upstream of the diversion and documented no fish. SSCRCD (1996) noted that the 123' concrete culvert at the confluence with Sonoma Creek at Arnold Drive and an 84' concrete flume upstream of the culvert (outside of SDC property) were partial fish barriers; they recommended baffles to improve fish passage at high winter flows. The diversion structure and 2' high dam were also noted to be a fish barrier. The survey team noted that the lower reaches of the watershed provided limited spawning habitat and the presence of fine sediment. In September 2002, wooden baffles were installed in the culvert and three rock step pools were constructed below the outlet (Young, 2018). According to Young, the retrofits are not functioning well currently and need repair, and SEC considers this a priority site for potential fish passage work.

LSA (2001) noted that Asbury Creek supported suitable fish habitat and documented the presence of unidentified fish, possibly speckled dace, California roach, or stickleback. Geomorphic channel surveys completed in the watershed in 2003 noted that the creek provides relatively poor quality habitat (Tessera Consulting and SEC 2004). The channel is steep and confined to a narrow channel, and areas of unstable banks and potential woody debris barriers are present. PCI did not observe any fish during surveys in summer 2017.

Based on these watershed conditions, there are numerous factors that may limit fish utilization within Asbury Creek. However, stream reaches do support perennial water with instream habitat and steelhead were present in the past. Special-status, perennial stream-dwelling foothill yellow-legged frog was observed on Asbury Creek in July 2017; see Special-status Species below. Asbury Creek also supports special-status California giant salamander (SSRCD 1996). The potential for re-establishment of steelhead should be further evaluated.

Butler Canyon Creek

Butler Canyon Creek is a seasonal drainage flowing across the southeastern corner of SDC. It flows south from SDC into Wilson Creek, which joins Sonoma Creek downstream of SDC. On SDC, the creek supports no fisheries resources. It does support wildlife habitat and seasonal habitat for aquatic species. As noted above, northern western pond turtles have been noted crossing under Highway 12 through a culvert on the creek. Improvements at all crossings are warranted; see Wildlife Crossings for additional information.

Roulette Springs

Roulette Springs, a complex of multiple small, spring-fed watercourses, forms a primary tributary to Asbury Creek. The springs originate north of Fern Lake. Portions of the springs are likely perennial, but flows are not substantial enough to support fisheries resources. The lush wetland vegetation and perennial water source provide important resources for local wildlife. The springs support potential habitat for foothill yellow-legged frogs, which occur downstream in Asbury Creek. Suitable foraging and refugia habitat is also present for California red-legged frogs. The shallower, fish-free aquatic habitat present at the springs is a habitat type not present at the reservoirs. However, the current water diversions at the springs may limit wildlife use and availability of water for local wildlife. Old barbed wire fences near the springs are not wildlife friendly and warrant removal.

Roulette Springs.

Fish Passage Barriers

Below are photos and brief descriptions of potential fish barriers on Sonoma, Asbury, and Hill Creeks on or adjacent to the SDC property, with assessments of their conditions and opportunities for potential enhancement.

Asbury Creek/Arnold Drive (off SDC property)

- Type: Box culvert under Arnold Drive, concrete flume upstream of Arnold Drive
- Notes/Opportunities: Baffles installed in Arnold culvert and step pools constructed, but these changes are not currently functioning well according to SEC (Young 2018); flume restricts passage at high flows based on 1997 CDFW Stream Inventory. Private property, outside of SDC jurisdiction.

Asbury Creek diversion (See Exhibit 7-A)

- Type: Flashboard dam
- Notes/Opportunities: Barrier when boards in place, but there are downstream barriers to address before habitat here is accessible.

Diversion and dam.

Sonoma Creek - SDC intake (See Exhibit 7-B)

- Type: Two concrete sills across channel at intake
- Notes/Opportunities: Partial barrier. One sill is partially notched. Complete an assessment, design, and implement an appropriate modification to ensure juvenile fish passage through the structure.

Looking towards right bank.

Hill Creek/ Redwood Drive (see Exhibit 7-C)

- Type: Box culvert, 8 feet wide, active channel width 9 feet, not embedded
- Notes/Opportunities: Significant barrier; perched concrete apron with pool below. 3.8 miles of habitat upstream.

Looking upstream.

Hill Creek/Arnold Drive (see Exhibit 6, Crossing 7)

- Type: Box culvert, 8 feet wide, active channel width 8.3 feet, embedded
- Notes/Opportunities: Full passage available. Upstream rock wall has been notched.

Looking downstream.

Hill Creek/ Pedestrian Footbridge (upstream of Arnold; see Exhibit 7-D)

- Type: Old rock wall and pipes
- Notes/Opportunities: Wall has been partially notched. Hazards from pipes.

Looking upstream

Hill Creek near ropes course (see Exhibit 7-E)

- Type: Concrete dam, approx. 3' wide
- Notes/Opportunities: Partial barrier, but downstream barriers to address before habitat is accessible.

Hill Creek (downstream of diversion) (see Exhibit 7-F)

- Type: Culvert, spillway with baffles for energy dissipation
- Notes/Opportunities: Complete barrier, but downstream barriers to address before habitat is accessible.

Looking downstream at culvert (top); looking downstream at baffles for energy dissipation (bottom)

Hill Creek diversion (see Exhibit 7-G)

- Type: Flashboard dam
- Notes/Opportunities: Barrier when boards are in place, but downstream barriers to address before habitat is accessible.

Looking upstream at diversion.

Reservoirs

Fern Lake and Suttonfield Reservoir are both man-made impoundments constructed specifically for SDC's water supply in the 1900s; however, they also serve as important wildlife habitat. These features provide open water habitat and aquatic vegetation along the margins. Like most reservoirs in California, they were stocked with non-native fish for recreational fishing. Both lakes support an abundance of warm water fish including bass and sunfish. "No Fishing" signs are posted at both reservoirs. Non-native crayfish and American bullfrog have also been documented at Fern Lake (LSA 2001) and bullfrogs at Suttonfield Lake. These non-native species serve as food sources for wildlife, especially piscivorous birds like double-crested cormorant, hooded merganser, great blue heron, and belted kingfisher, all of which have been seen on SDC, and mammals like river otters and raccoons. However, non-native aquatic species can be detrimental to native fish and wildlife and need to be carefully managed. These non-native species can compete directly with and prey on native wildlife. For example, the presence of non-native fish and American bullfrog within the reservoirs may preclude California red-legged frog from successfully breeding there.

Bullfrogs are at a competitive advantage due to their larger size and longer breeding season. They have been known to prey upon red-legged frogs and outcompete the species. California red-legged frogs have not been documented in the reservoirs, but in the absence of fish these features would provide excellent breeding habitat. Both reservoirs provide suitable habitat for northern western pond turtle. Two turtles were observed in November 2014 in Fern Lake during a citizen science wildlife survey (Hunn 2015).

The open water reservoirs also provide foraging opportunities for waterfowl and wading birds which consume aquatic invertebrates and plants. Mallard, pied-billed grebe, western grebe, Canada goose, American wigeon, bufflehead, common goldeneye, ruddy duck, and great egret are common visitors to SDC. Smaller songbirds may use the habitats for foraging and nesting. Black phoebes and swallows sally over aquatic habitats, catching insects on the wing. Red-winged blackbirds and marsh wrens commonly nest along reservoir margins in emergent vegetation. Many birds (e.g., swallows, Steller's jay, American robin) also rely on exposed mud banks along the water's edge for construction of all or portions of their nests. Small and large mammals are attracted to reservoirs not only as a direct source of water, but also to prey on abundant wildlife. The unobstructed open water is very important for bats which drink in flight and require large swoop zones. These reservoirs provide a year-round water supply for wildlife and serve as valuable watering holes when other sources have dried up.

Canada geese along the margins of Lake Suttonfield.

Widow skimmer dragonfly at Fern Lake.

Wetlands and Ponds

Seasonal wetlands occur along upper drainages, in seeps and swales throughout the oak savannahs, within the low-lying valley on the east side of the property, and along Roulette Springs. Two ponds are also present: a 0.5-acre pond on the east side of the property near Suttonfield Lake and the large wetland, and a small 0.1 acre pond below the water treatment plant. These seasonal features, like the reservoirs, are important habitat for wildlife. Wetlands and ponds support a suite of endemic invertebrates that are well-adapted to life in these seasonal environments. These include a variety of crustaceans such as clam shrimp, copeopods, and water fleas, and aquatic beetles, dragonflies, damselflies, aquatic snails and worms, and zooplankton. These invertebrates serve as a food source for amphibians and birds.

Within the seasonal wetlands, shallow pockets of water provide breeding habitat for common Sierran treefrog, which is most active during winter months. The larger of the two ponds also support breeding western toad; toadlets are common along the water's edge in spring and summer. Juvenile non-native American bullfrogs were observed at the large pond as well, suggesting this feature holds water throughout the year (bullfrogs require perennial water for successful breeding; they generally overwinter as tadpoles). Evidence of amphibian breeding was not observed at the water treatment plant pond, but it is likely an important resource for local amphibian populations and other wildlife species as well. Both ponds may support California red-legged frog breeding and foraging habitat, but they have yet to be

documented on the property. The largest pond is stocked with mosquito fish. Associated wetland and adjacent upland vegetation provides additional foraging habitat, cover, and nesting sites for wildlife and an important water resource.

Pond on east side of property.

Pond below water treatment plant.

Non-native American bullfrog at east side pond.

Developed Areas

The wildlife habitat values of developed areas are generally considerably less than those of the surrounding natural habitats. Wildlife in the developed areas are typically more acclimated to human activity and include species common in urban and suburban habitats. Common mammals include native raccoon, striped skunk, and non-native Virginia opossum, rats, and mice. Black-tailed deer are common throughout the core campus. California ground squirrels and their burrows are abundant around John Mesa field and Camp Via. Ornamental trees and shrubs provide roosting and potential nesting substrate for numerous species of birds. Mature valley oaks and palms within the core campus are used by woodpeckers to cache acorns. Other common native birds include western scrub-jay, northern mockingbird, and house finch. MacDonald (2015) has made personal observations of a colony of hundreds of Vaux's swift emerging from a chimney in one of the old buildings on the property. Many of the old buildings and structures on the property support wildlife as well. Many bird nests were observed around the building perimeters. Non-native birds are prevalent including house sparrow, European starling, and rock dove. Buildings with minimal human intrusion and exterior access provide roosting habitat for many local bat species as well. No formal bat survey has been conducted. Rattlesnakes are also common in the developed areas. According to SDC staff, they are found throughout the core campus and the cement sidewalks surrounding Camp Via are used extensively.

Special-status Species

SDC supports known or potential habitat for a number of special-status species. Special-status species include plants and animals native to California that are afforded legal protections because they are at risk. These species occur in small isolated populations or in fragmented habitat, show a marked population decline, depend on habitat that has been greatly reduced or is threatened by further loss, or have historical records in the state but no longer persist. These species require careful consideration for resource management actions or land-use changes.

The potential for occurrence of special-status species on SDC was determined based on occurrences reported in the California Department of Fish and Wildlife's California Natural Diversity Database (CNDDB), the primary source for special-status plant and animal sighting information in the state (CDFW 2017a), background and literature review, and on-site conditions observed by PCI. Existing habitat and microhabitat conditions

Special-status plants and animals *include those species that are afforded legal protection under the federal and California Endangered Species Acts (ESA and CESA, respectively) and other regulations, including:*

- *Species listed or proposed for listing as threatened or endangered under the federal and California ESA or proposed for listing under the California ESA;*
- *Species that are recognized as candidates for future listing by agencies with resource management responsibilities;*
- *California Species of Special Concern and Fully Protection species classified by CDFW*
- *Mountain lions protected under the California Wildlife Protection Act of 1990 (Proposition 117) and designated as a "specially protected mammal in California;"*
- *Plant species, subspecies, and varieties defined as rare or threatened by the California Native Plant Protection Act;*
- *Certain plant species listed by the California Native Plant Society; and*
- *Species that otherwise meet the definition of rare, threatened, or endangered as described in the CEQA Guidelines.*

relative to species needs, proximity to reported occurrences, and geographic range of subject species were considered.

Special-status Plants

Based on site conditions, CNDDB data, and plant records from the vicinity (Calflora 2017), a number of special-status plant taxa have moderate potential to occur on SDC. No focused botanical surveys of the entire site have been undertaken to date. Surveys for this project were more general in nature and occurred after the typical blooming period for many species. The northwestern portion of the property was surveyed in 2000 and 2001 (LSA 2001). Given the presence of high-quality habitat on the property, spring surveys and/or focused surveys prior to proposed new site development would be beneficial for developing a more complete understanding of the site's botanical resources, and to determine whether any special-status species are present. Exhibit 4 shows locations of special-status plants with CNDDB records in the vicinity of SDC.

The following species have low to moderate potential to occur on the property, based on the habitats and conditions present and the proximity of other reported occurrences. All but three of these are considered rare, threatened, or endangered in California and elsewhere, and fairly endangered in California (California Native Plant Society Rare Plant Rank [CRPR] 1B.2). The other three (noted in table below) are considered of limited distribution in California, and fairly endangered in California (CRPR 4.2).

Table 3. Special-status Plant Species with Potential to Occur at SDC

Species	**Description**	**Typical Habitat** (CNPS 2017)	**Recorded Occurrences in Vicinity** (based on CDFW 2017a unless otherwise noted)	**Potential to Occur on SDC**
Big-scale balsamroot (*Balsamorhiza macrolepis*)	Perennial herb, yellow sunflower-like flowers	Grassland, chaparral, woodland, sometimes serpentine	Near Sonoma	Moderate – in grassland and oak woodland.
Chaparral or redwood lily *(Lilium rubescens)*	Perennial bulb, white to pink flower. CRPR 4.2	Sometimes serpentine, sometimes roadsides, in chaparral or forest gaps	Bouverie Preserve, Jack London SHP[4]	Moderate – in forest gaps.
Fragrant fritillary (*Fritillaria liliacea*)	Perennial bulb, cream-colored flower	Grassland or scrub, often clay or serpentine	Jack London SHP vicinity	Moderate – less-disturbed grasslands where other native species present and soils clayey, but not observed in past surveys of northwestern part of property (LSA 2001), where clayey soils present.

[4] Based on Calflora (2017) records.

Species	Description	Typical Habitat (CNPS 2017)	Recorded Occurrences in Vicinity (based on CDFW 2017a unless otherwise noted)	Potential to Occur on SDC
Franciscan onion (*Allium peninsular*e var. *franciscum*)	Perennial bulb, pink flower	Grassland, woodland, often clay soils, serpentine	Several nearby locations	Moderate – less-disturbed grasslands where other native species present and soils clayey, but not observed in past surveys of northwestern part of property (LSA 2001), where clayey soils present.
Harlequin lotus *(Hosackia gracilis)*	Perennial herb, pink and yellow flower. CRPR 4.2.	Wetlands, roadsides within many settings	Jack London SHP[2]	Moderate – wetland edges where dense non-native growth not present.
Hayfield tarweed *(Hemizonia congesta)*	Annual forb, white flower	Grassland	Jack London SHP[5]	Moderate – less-disturbed grasslands.
Jepson's leptosiphon (*Leptosiphon jepsonii*)	Annual forb, pink flower	Partially shaded grassy slopes, volcanic soils or serpentine periphery	Several nearby occurrences, including west side Sonoma Mountain	Moderate - less-disturbed grasslands, especially where other native grassland species and volcanic soils are present. A related species, variable linanthus (*Leptosiphon parviflorus)*, was observed north of Fern Lake in the past (LSA, 2001).
Napa false indigo (*Amorpha californica*)	Deciduous shrub, pea family, dark purple flower	Openings or filtered shade within woodland or forest	Several nearby occurrences, including Bouverie Preserve	Moderate – deciduous oak woodland. Not observed to date.
Narrow-anthered brodiaea (*Brodiaea leptandra*)	Bulb, purple flower	Volcanic soils in grassland, woodland, chaparral	Cavedale Road area	Moderate - less-disturbed grasslands, especially where other native grassland species and volcanic soils are present.
Pink star-tulip *(Calochortus uniflorus)*	Bulb, lavender flower. CRPR 4.2.	Coastal prairie and scrub, meadows, seeps, coniferous forest	Jack London SHP[2]	Low – meadows present but highly disturbed.

Other special-status plant species that have been reported to occur in the SDC vicinity but which are not likely to be present on the property due to a lack of suitable habitat include vernal pool species [dwarf downingia (*Downingia pusilla*), legenere (*Legnere limosa*)], and chaparral and knobcone pine species [Cobb Mountain lupine (*Lupinus sericatus*), Sonoma ceanothus (*Ceanothus sonomensis*), Sonoma canescent manzanita (*Arctostaphylos canescens* ssp. *sonomensis*)].

[5] Based on Calflora (2017) records, not CNDDB.

Special-status Animals

The following table and descriptions include special-status animal taxa observed on SDC lands, identified as having a high potential for occurrence, or having historical significance. In addition, a number of special-status birds and mammals have been documented on the property or have potential to occur there; these species are indicated in Appendices B and C, but not described below. The focus of this section is to highlight the wildlife and fish species with the most pressing management needs. The presence or potential for occurrence of these species based on documented occurrences nearby warrants further consideration in site planning.

Table 4. Special-status Fish and Wildlife Species and Habitat Utilization

Species	Sonoma Creek	Asbury Creek	Hill Creek	Butler Canyon Creek	Suttonfield Lake	Fern Lake	Roulette Springs	Redwood/ Fir Forest	Buildings
California freshwater shrimp	O	P	P	-	-	-	-	-	-
Steelhead	O	P	P	-	-	-	-	-	-
California giant salamander	P	O	P	-	-	-	P	P	-
Foothill yellow-legged frog	P	O	P	-	-	-	P	-	-
California red-legged frog	P	P	P	-	P	P	P	-	-
Red-bellied newt	P	P	P	-	-	-	P	P	-
Northern western pond turtle	P	P	P	O	P	O	P	-	-
Northern spotted owl	-	-	-	-	-	-	-	O	-
Bats*	P	P	P	P	P	P	P	P	P

O = occupied habitat; documented occurrence of species

P = potential habitat; suitable habitat elements present

* = bat occurrences refer to roosting and foraging; buildings on SDC may support bat roosts

List of special-status species is not exhaustive. Focal special-status species may occur outside of these core habitats in nearby areas (e.g., during migration, aestivation).

INVERTEBRATES

California Freshwater Shrimp (*Syncaris pacifica*)

Status: Federally and State-listed as endangered

The California freshwater shrimp is a small, 10-legged crustacean occurring in low-elevation and gradient (less than 1%) perennial streams in Marin, Sonoma, and Napa counties. They occur in shallow pools away from the main current where they feed primarily on detritus and, to a lesser extent, on decomposing vegetation, dead fish, and invertebrates. Most shrimp appear opaque to nearly transparent with colored flecks across their bodies. Females can appear dark brown to purple under certain conditions. Breeding occurs in the autumn, but young do not hatch until the following May or early June. After breeding, female shrimp carry the fertilized eggs attached to their abdominal swimming legs throughout the winter. The freshwater shrimp has been extirpated from many streams and continues to be threatened by introduced predators, pollution, and habitat loss.

Local Occurrence: California freshwater shrimp are known to occur on the SDC property. Sonoma Creek is a known habitat for this species. Local retired CDFW biologist, Bill Cox, has surveyed the SDC reach and habitats immediately upstream and downstream and found shrimp to be fairly abundant (Cox 2014). Portions of Hill and Asbury Creeks appear suitable to support this species and should be considered important habitat (LSA 2001).

Suitable California freshwater shrimp habitat on Sonoma Creek – undercut banks with overhanging alder roots.

FISH

Steelhead – Central California Coast DPS (*Oncorhynchus mykiss*)

Status: Federally listed as threatened

Steelhead are anadromous salmonids. They migrate upstream from the ocean during the rainy season, anytime from November to March. They typically spawn (mate and lay eggs) at the downstream edge of pools where cover habitat exists nearby for predator protection. Eggs are laid in a redd, a depression dug into cobble or gravel substrate. Steelhead can migrate out to the ocean after spawning and return in subsequent years to spawn again. Eggs hatch in 30 to 60 days, depending on stream temperatures. The newly hatched fish, alevins, stay in the gravel for a few additional weeks until their yolk sac is absorbed. When they emerge, they seek slow-water areas, often at the stream margins. As they grow bigger, the juvenile fish move into faster water to feed on drifting insects. Juvenile steelhead remain in freshwater streams from one to three years, depending on their rate of growth. Rearing juveniles have many habitat requirements. Most importantly, they need sufficient, cool streamflow to transport drifting insects for feeding and cover habitat, such as undercut banks, woody material, boulders, and deep pools, to hide from predators and areas for refuge during high flows. When juveniles are large enough, they migrate out to the ocean as smolts. During out-migration, steelhead need adequate streamflow to swim past barriers and cover for predator protection.

Local Occurrence: Steelhead are known to occur on the SDC property. Sonoma Creek is a known habitat for this species. Steelhead have also been reported in Asbury and lower Hill Creeks. However, both tributaries have fish passage barriers that may obstruct movement in these drainages. Sonoma Creek has a partial barrier at SDC's intake. Two concrete sills are present at this location. One is notched and the other is not; the un-notched sill acts as a low-flow partial barrier. It most likely restricts passage during times when the water is lower, such as summer and fall, especially for juvenile fish, California freshwater shrimp, and other aquatic life. Sonoma, Hill, and Asbury Creeks are designated critical habitat for central California coast steelhead (USFWS 2005).

AMPHIBIANS

California Giant Salamander (*Dicamptodon ensatus*)

Status: CDFW Species of Special Concern

California giant salamanders utilize wet coastal forests near permanent and semi-permanent streams and springs. This species is one of the largest terrestrial salamanders in North America. Breeding occurs mostly in spring, but

sometimes fall. Eggs are laid in water and larvae exhibit an enlarged tail fin for swimming with external gills. They transform into land-dwelling salamanders with lungs around 18 to 24 months. They consume a wide variety of animals from small invertebrates to salamanders, rodents, and lizard; they exhibit a sit and wait feeding style. This species is endemic to California.

Local Occurrence: California giant salamanders were documented in Asbury Creek during a stream inventory of the watershed completed by CDFW in 1996 (SSRCD 1996) and during a survey by Barber et al. (2012). Salamanders may utilize Asbury, Hill, and mainstem Sonoma Creeks for breeding and adjacent woodlands during their terrestrial adult stage. Suitable habitat for giant salamanders is present within the SDC property.

Foothill Yellow-legged Frog (*Rana boylii*)
Status: CDFW Species of Special Concern, candidate for protection as threatened species under CESA (CDFW 2017b)

Foothill yellow-legged frog observed on SDC.

The foothill yellow-legged frog is found in or near partly shaded rocky streams from near sea level to 6,300 feet in a variety of habitats (Thomson et al. 2016). Breeding generally occurs from mid-March to early June after high winter flows have subsided. Egg masses are attached to the downstream side of rock and gravel in shallow, slow, or moderate-sized streams. Tadpoles require three to four months to attain metamorphosis. Adults take aquatic and terrestrial invertebrates, and tadpoles graze along rocky stream bottoms on algae and diatoms. During all seasons, this species is generally found in or within close proximity to streams. Primary threats to this species include water management practices, non-native predators, pesticides, recreational activities along streams, habitat loss, and disease.

Foothill yellow-legged frog habitat on SDC.

Local Occurrence: Foothill yellow-legged

frogs are known to occur within tributaries to Sonoma Creek (CDFW 2017a). In July 2017, PCI documented the presence of a single foothill yellow-legged frog in Asbury Creek on the SDC property. PCI observed frogs in the summer of 2014 in Stuart Creek, a Sonoma Creek tributary to the northeast of SDC, under similar habitat conditions (PCI 2014). They have also been recently sighted in tributaries on the west side of Sonoma Mountain in Adobe and Copeland Creeks (Wilcox 2015). Suitable habitat for foothill yellow-legged frog in present in Asbury and Hill Creeks, Roulette Springs, and mainstem Sonoma Creek within the SDC property. The current water diversions and instream barriers on SDC may limit the use of habitat by foothill yellow-legged frog by reducing the availability of water and restricting movement.

California Red-legged Frog (*Rana draytonii*)
Status: Federally listed as threatened and CDFW Species of Special Concern

The California red-legged frog is the largest native frog in the western U.S. with females reaching up to 5¼ inches in length and males being slightly smaller. They are most common in marshes, streams, lakes, reservoirs, ponds, and other water sources with plant cover. Breeding occurs in deep, slow-moving waters with dense shrubby or emergent vegetation from late November through April. Floating egg masses are attached to emergent vegetation (e.g., *Typha* sp. or *Scirpus* sp.) near the water's surface. Tadpoles require 3½ to 7 months to attain metamorphosis. During the non-breeding season, California red-legged frogs can remain at the breeding site (in the presence or absence of water) or move into surrounding non-breeding habitats. Radio tracking of frogs in Marin County found that frogs disperse at a median distance of 500 feet from breeding sites (range of 100 to 4,600 feet) and make year-round small-scale (<100-foot) movements around breeding sites (Fellers and Kleeman 2007). These results indicate the importance of uplands for non-breeding season and migratory corridor habitat. Adults eat invertebrates and small vertebrates. Larvae are thought to be algal grazers. Primary threats to this species include loss and degradation of habitat and non-native predators (USFWS 2002).

Local Occurrence: Suitable habitat for California red-legged frogs is present on SDC. SDC's aquatic habitats could support breeding. However, the presence of non-native fish and bullfrogs may be precluding frogs from successfully breeding on the property. Frogs have been reported on SCAPOSD-owned lands on the north slope of Sonoma Mountain (PCI 2012), at Fairfield Osborn Preserve, and in Annadel State Park (CDFW 2017). Focused surveys at Jack London Lake in the adjacent Jack London SHP have not found any frogs, although suitable habitat is present (Fawcett 2011). All aquatic habitats on the property warrant further evaluation.

Red-bellied newt (*Taricha rivularis*)
Status: CDFW Species of Special Concern

Red-bellied newts are a stocky, medium sized salamander of coastal woodlands and redwood forests. Breeding occurs stream and rivers; newts typically enter breeding sites in February and can breed into May. Clusters of 10 eggs are attached to rocks and roots within a stream. Egg development is temperature depended and can take up to one month. Larvae transform in 4 to 6 months in late summer or early fall. Adults are terrestrial during the non-breeding season. They consume a variety of invertebrates. This species is endemic to California and has the most limited distribution of our three species of *Taricha*. Impacts to streams and vehicular mortality are the primary threats to this species.

Local Occurrence: The nearest red-bellied newt occurrence in the Sonoma Valley area is from a collection made in 1977 (CDFW 2017a). The specimen was documented in a "mountain range overlooking Valley of the Moon." Additional sightings are reported to the north of SDC in Santa Rosa and Mark West Creeks. Suitable habitat for red-bellied newts is present within the SDC property.

REPTILES
Northern Western Pond Turtle (*Actinemys marmorata*)
Status: Under review for federal listing and CDFW Species of Special Concern

The northern western pond turtle, the only native turtle in Northern California, reaches up to 8 ½ inches in length. These turtles are most commonly found in or near permanent or semi-permanent water sources in a variety of suitable habitats below 4,700 feet elevation. This omnivorous species requires basking sites, such as emergent logs, rocks, mud banks, or mats of aquatic vegetation, for thermoregulation. Underwater retreats are also required for predator avoidance. Nesting sites of this species have been found some distance, up to 1,300 feet or more, from aquatic habitat. Three to 14 eggs are laid in shallow holes dug by the female from April through August. Nest sites include, but are not limited to, areas with sparse vegetation of short grasses and forbs, in hard-packed clay or silt soils, and along south- or west-facing slopes (Bettelheim, 2005). Eggs hatch in late summer or fall, but the juveniles remain buried until the following spring; thus, nests are vulnerable to trampling year-round. Pond turtles have also been found using upland sites for aestivation and overwintering. They are dietary generalists consuming a variety of food items including aquatic invertebrates, carrion, and vegetation. Pond turtles experienced a population decline across their range due to commercial hunting during the late 1800s and early 1900s when they were harvested for use in soups and stews. Continued threats to this species include loss and degradation of habitat and widespread introduction of non-native predators including bullfrogs and fish.

Local Occurrence: The reservoirs and ponds on SDC and creeks support suitable habitat for pond turtles. This species is known to occur well upstream of the SDC near Oakmont (CDFW 2017a). Sonoma Mountain

Ranch Preservation Foundation (SMRPF) reports pond turtles have been residents on the top of Sonoma Mountain since the property was purchased in the 1970s (SMRPF 2017). On SDC, two turtles were observed in November 2014 in Fern Lake during a citizen science wildlife survey. These were likely northern western pond turtles, as Hunn (2015) reports they lacked the striping and coloration of introduced red-eared slider. Northern western pond turtle has also been observed at the northern Butler Canyon Creek undercrossing of Highway 12 (Nelson 2017).

BIRDS

Northern Spotted Owl (*Strix occidentalis caurina*)

Status: Federally listed as threatened and CDFW Species of Special Concern; candidate for protection as threatened species under CESA; California Fish and Game Commission has determined the action is warranted (CDFW 2017b).

The northern spotted owl is an uncommon permanent resident of dense forest habitats in northern California and oak and oak-conifer habitats in southern California. This nocturnal species requires dense, multi-layered canopy cover for roosting sites. Spotted owls feed upon a variety of small mammals, birds, and large arthropods. Nest sites include tree or snag cavities or broken tops of large trees. The typical breeding period lasts from early March through June, rearing two young per season. A pair of owls may utilize the same breeding site for five to 10 years; however, they may not breed every year. Individual territories are typically several hundred acres. The spotted owl has experienced a population decline due to the loss and degradation of existing mature and old growth forests and, most recently, the establishment of barred owls in the west. They are a fairly common permanent resident in Sonoma County where they occupy old-growth coniferous forests of redwood, Douglas-fir or pines blended with smaller evergreen hardwoods (Bolander & Parmeter 2000, Burridge 1995).

Local Occurrence: Suitable habitat for spotted owls is present within the forested habitats on SDC. Established territories are reported in Jack London SHP just outside of the SDC property boundary and on adjacent private lands (Evens 2009). Given the close proximity of reported territories and existing conditions, the forest and dense woodland habitats on SDC are likely to support northern spotted owl. Further focused surveys for northern spotted owl within SDC are warranted to determine current habitat use and evaluate potential impacts of land use changes on this species.

MAMMALS

Mountain Lion (*Puma concolor*)

Status: Designated as a "specially protected mammal in California" under California Wildlife Protection Act of 1990 (Propositions 117)

Mountain lions, also referred to as cougars or pumas, are the largest cat in California. These large predators can reach up to 6.7 to 7.9 feet (females and males, respectively), from nose to tail tip. They have a plain, tawny colored coat, long tail, round head, and erect ears. Infants and juveniles exhibit spotting on their coat. Mountain lions occupy forested, wooded, and brushy habitats throughout their range. They are primarily solitary animals, shy, and seldom seen. Home range size can vary based on terrain, vegetation, and prey abundance. They are an ambush predator, and feed primarily on deer in this region, but will also take other small mammals and occasionally livestock. They reach sexual maturity at 1.5 to 2 years old and can produce a litter of kittens every 2 to 3 years. After a 90-day gestation period, 1 to 6 cubs are born; survival rates are just over one per litter. Young remain with their mothers for up to two years before establishing their own territory. Life expectancy is 8 to 13 years. The most serious threats

to mountain lions are hunting and loss of habitat.

Local Occurrence/Research: Mountain lions are known to occur throughout the Sonoma and Mayacamas Mountains range and on SDC lands. As noted above, the ACR Mountain Lion Project is actively tracking four lions in the Sonoma Valley area – one adult female (P1), a female offspring of P1 (P2), a male with overlapping territory (P5), and a female near Sonoma (P4) with two cubs (not collared). Based on preliminary data by ACR, SDC is used primarily by P1 and P2 with occasional visits from P5. Most of the observations on SDC are limited to the west side of Arnold Drive in areas with some canopy cover. No detections have been made on the east side near Suttonfield Lake, but PCI noted the presence of mountain lion scat during a field survey of this area Not all lion movements are recorded by ACR given the current data collection methods. Further study of mountain lion habitat use and movement on SDC is warranted to evaluate potential impacts of land use changes on this species.

American Badger (*Taxidea taxus*)
Status: CDFW Species of Special Concern

American badgers are a widespread, uncommon resident across California; they are found year-round in Sonoma County. They measure 30-35 inches, with a short furry tail, approximately 5.5 inches. They have a flat-backed appearance. They are typically gray with a white stripe from nose to shoulders. Claws can be up to 2 inches. They occur in a variety of habitat types (e.g., herbaceous, shrub, or forest habitats) with dry, friable soils. They are carnivorous and consume primarily burrowing rodents but will also eat reptiles, insects, eggs, birds, and carrion. Badgers are territorial throughout the year with size of the territory dependent on the availability of food. Typical territory size is approximately 3 to 4 square miles; underground dens can be quite extensive and include many entrances. Mating occurs in summer and early fall with young (usually 2 to 3) born in early spring. Badgers can tolerate some level of human activity.

Local Occurrence: In 2015, SMRPF documented the first American badger sighting in 20 years on the top of Sonoma Mountain (SMRPF 2017). In March 2015, badger activity was captured on a remote camera placed in a recently burned meadow. There is anecdotal information that a badger has been seen on the east slope of Sonoma Mountain closer to SDC, but the sighting has not been confirmed. Badgers burrows and dens have not been observed on SDC, but suitable habitat is present within the property. Further assessment of American badger activity on SDC is warranted to evaluate potential impacts of land use changes on this species.

BATS
SDC supports a wide variety of habitats that provide critical foraging and roosting habitat for a number of bat species. There are approximately 25 bat species with known occurrences within Northern California, and at least 12 of these species have a high probability of occurring on SDC. Bats are highly mobile; many are migratory. Foraging habitats range from woodlands, forests, and grasslands to open water. All of our local Sonoma County species are insectivorous and feed by echolocation. Bats use caves, mines, buildings, bridges, tree hollows, and other natural and man-made crevices for roosting. While focused surveys for bats have not been performed on SDC, they would be sure to reveal a number of species utilizing the existing habitats or structures, especially given the age and condition of many of the buildings. One special-status bat species has reported occurrences near SDC (pallid bat) and another has high potential for occurrence (Townsend's big-eared bat) (CDFW 2017a). Additional bat species (i.e., fringed myotis, long-legged myotis, Yuma myotis) identified as having moderate to high priority for conservation by the Western Bat Working Group, may also occur on the property (see Appendix B).

Pallid Bat (*Antrozous pallidus*)
Status: CDFW Species of Special Concern

The pallid bat occupies grassland, shrubland, woodland, and forest habitats at low elevations in California. It can most commonly be found in open, dry habitats with suitable rocky areas for roosting. This species can also be found roosting in caves, crevices, mines, hollow trees, and buildings during the day. Night roosts generally consist of more open areas such as porches and open buildings. Pallid bats feed on large flightless arthropods which they capture from the ground – a unique foraging strategy in comparison with other bat species. The pallid bat is a yearlong resident throughout most of its range. During the non-breeding season, both sexes may be found roosting in groups of 20 or more individuals. Young are born from April to July. As with many bat species, pallid bats are extremely sensitive to roosting site disturbance.

Local Occurrence: Suitable habitat for pallid bats is present in the natural habitats and man-made structures on the property. Pallid bats have been reported in nearby Jack London SHP (CDFW 2017a). Focused surveys of all the buildings should be completed prior to any proposed repairs and for trees prior to removal to evaluate species presence and potential impacts of land use changes on this species.

Townsend's Big-eared Bat (*Corynorhinus townsendii*)
Status: CDFW Species of Special Concern; candidate for protection under CESA; California Fish and Game Commission has determined the action is not warranted (CDFW 2017b)

Townsend's big-eared bat occupies low to mid-elevation moist habitats including, riparian, mixed forest, coniferous forest, prairies, and agricultural lands. This species emerges in late evening and forages for small moths and insects which it picks from leaves. Their flight pattern is slow and maneuverable and they are capable of hovering. Roosting sites include caves, mines, tunnels, buildings, and other man-made structures. Unlike other bat species, Townsend's do not tuck themselves in crevices and prefer open roosts with their fur erect and ears tucked back for optimal thermoregulation. Mating typically occurs in winter with a single young born in May or June. Maternal roosts consist of a small number of females and young, typically less than 100 individuals. Townsend's are a year-round resident in California.

Local Occurrence and Observations: Suitable habitat for Townsend's big-eared bats is present in the natural habitats and man-made structures on the property. There are no reported occurrences of Townsend's in nearby areas, but this is likely a result of under-reporting as they are likely to occur within Sonoma Valley (CDFW 2017a). Focused surveys of all the buildings should be completed prior to any proposed repairs and trees prior to removal to evaluate species presence and potential impacts of land use changes on this species.

7 People and Nature at the SDC Site

SDC's expansive landscape provides ecological functions that are critical to human well-being on the property and in the region. At the same time, the presence and influence of people on the land and its functions is evident throughout. This section discusses the intersection of people and natural systems on the site, with an overview of key ecosystem services provided, a description of the recreational facilities present, an overview of current human influences on the land, and the regulatory policies relevant to conceptual planning for SDC's future.

Ecosystem Services

Natural systems and their functions provide the foundation for human existence. To help illuminate this relationship, and to help people consider it in decision-making, natural functions are often described in terms of "ecosystem services." These services can be classified into four groups:

- **Provisioning services** – products including food, water, energy, and other raw materials for human activity
- **Regulating services** – natural processes that help maintain the conditions needed for human survival, such as purifying water and air, preventing erosion and flooding, regulating climate, decomposing of materials, and pollination
- **Cultural services** – non-material benefits supporting the development of ideas, knowledge, and well-being, including spiritual inspiration, educational and recreational opportunities and their benefits to human health
- **Supporting services** – the fundamental natural processes that allow all other services to continue. These include photosynthesis, nutrient cycling, and sustenance of biodiversity.

For some projects, analysts attempt to place monetary values on these services. Economic valuation of processes intrinsic to human survival is challenging, complex and inevitably limited in scope, but may be helpful when considering alternatives for goods or services with clearly defined markets. For instance, water purification costs and benefits for a small town might be compared for two options -- protecting the town's forested watershed for natural purification versus constructing new engineered water purification systems. Valuation of carbon sequestration services is another emerging field that aims to support climate-smart policy decisions. Dollar values of provisioning outputs like livestock and crops are readily calculated. There may also be significant savings to government agencies in avoided costs when land is kept wild rather than converted to housing or commercial endeavors. However, not all services of value to people can be readily priced as a marketable good. Cultural and supporting services in particular may be hard to incorporate into financial analyses.

The SDC site provides--or has in the past or has future potential to provide--an array of valuable ecosystem services to the people of Sonoma County and beyond. Exhibit 8 provides a visual representation of how selected services are distributed across the site; see sections below for explanation.

Provisioning Services

- Production of timber, livestock, fish and game, fruit, crops
- Provisioning of surface and groundwater for drinking water, irrigation, and commercial use
- Pollination for agricultural plants

Provisioning services are generally the functions people are the most familiar with, and may be the easiest to place monetary values on. SDC's conifer forests and oak woodlands have historically provided timber for construction and wood for fuel. The grasslands and wet meadow have supported livestock for meat, milk, and working animals. Healthy soils of both uplands and lowlands on the site have supported orchard fruits and nuts and row crops. The site's forested slopes, healthy riparian zones, and wetlands collect rainfall, facilitate its infiltration into soil, and gradually release it into Asbury, Hill, and Sonoma Creeks, or underground aquifers, providing water for domestic use as well as irrigation throughout the site and beyond. Diverse habitat types, healthy soils, and a wide array of flowering plants provide the year-round resources that pollinators, from native bees to honeybees, require as they pollinate on-site or nearby crop and orchard species.

Exhibit 8 illustrates groundwater recharge services provided across the site, based on studies by SEC and SCWA (2014).

Regulating Services

- Carbon sequestration
- Water regulation – groundwater recharge, moderation of floods and stream flows
- Air quality protection
- Soil formation and retention
- Waste treatment – decomposition and filtration of human and animal wastes

Regulating services keep the environment suitable for human life. As changing climate is one of the world community's most pressing challenges, carbon sequestration services are of critical interest. All of SDC's intact habitats incorporate and store carbon, offsetting the accumulation of heat-trapping carbon dioxide in the atmosphere due to human activity. Plants grow by incorporating carbon from the atmosphere into roots, stems, leaves, and soil. Long-lived trees like oaks and redwoods provide the greatest benefits, but all of SDC's forests, woodlands, wetlands and grasslands sequester substantial carbon. Exhibit 8 illustrates carbon sequestration levels across the site, based on LiDAR-derived data provided by the Sonoma Veg Map project (SCAPOSD 2017).

The Sonoma County Agricultural Preservation and Open Space District recently completed a study of climate benefits of land conservation (Climate Action Through Conservation [CATC]; SCAPOSD 2016). Their report notes that an average acre of Sonoma County redwood forest contains roughly 528 tons of carbon dioxide equivalent (tCO2 e), including the carbon in trees, roots, downed wood, litter, and soil. For comparison, one tCO2 e is emitted by burning 112 gallons of gasoline in a car. There is also potential to increase carbon sequestration on the SDC site; CATC notes the value of valley oak restoration and riparian restoration for increasing carbon sequestration. In contrast, if SDC's intact habitats were converted to developed areas or vineyard, the land would no longer serve as a carbon "sink" but would generate those uses would generate carbon dioxide, via the use of fossil fuels, loss of vegetation, and soil management practices.

The CATC study provides conservative monetary values for the "social cost of carbon"—an estimate of the long-term economic cost to society attributable to greenhouse gas emissions. Their estimate is based on US Environmental Protection Agency methods, but the authors note that these dollar figures do not include potentially very costly but hard-to-predict outcomes like human migrations due to climate change. The social carbon cost they use also excludes costs for which monetary data is not yet available, including damages to fisheries and effects of increased pest, disease, and fire pressures on agriculture and forests. Therefore, this estimate is considered a lower bound for carbon impact costs. The EPA also provides an upper-end estimate that captures more of the uncertain costs. The conservative estimate of the social cost of carbon in 2017 is approximately $38 per tCO2e, while the upper end estimate is approximately $110 (US EPA 2017). See SCAPOSD (2016) and US EPA (2017) for further discussion. These figures could be used to help develop a monetary value for the sequestration services provided by SDC's intact habitats.

Water regulation provided by SDC is of great local value. The Sonoma Valley in general has limited water resources, but most local residential and agricultural uses require abundant clean water. The intact slopes, meandering watercourses, and complex native vegetation on SDC's slopes and along streams help slow the movement of water, allowing for capture or filtration of sediments or other contaminants and infiltration into groundwater or gradual release into stream courses. This protects water supply and quality for SDC itself but also for downstream users. The broad, gently sloping wet meadow on the east side is an example of an area that allows for the slow movement and infiltration of water. In contrast, paved roads and parking lots and other impermeable surfaces do not absorb water, resulting in rapid runoff, addition of pollutants from road surfaces, and greater erosion when flows re-enter permeable areas.

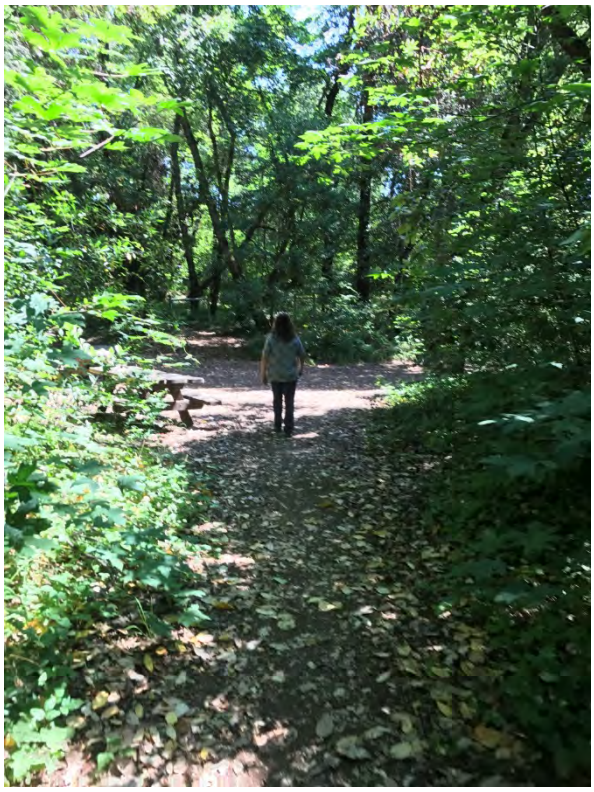
Buffers of intact habitat between stream channels and development also help protect roads and buildings from flooding during major winter storms. These buffers also allow for some natural adjustment in stream courses over time, protecting structures from undercutting by erosion. As our climate becomes more volatile, these buffers will be increasingly valuable.

Other regulating services of the SDC landscape include protection of air quality. Forests remove air pollutants such as particulates, nitrogen dioxide and sulfur dioxide from smoke, burning of fossil fuels, and other human activities. Forests and urban trees can also help mitigate high temperatures—an increasingly important function as climate warms. By shading and evapotranspiration, SDC's trees have potential to reduce impacts of extreme heat on people, and to reduce the energy usage and dollar costs of air conditioning. Another service is provided by the site's healthy soil biota and decomposers recycling

dead plant and animal matter and animal waste into soils that support our crops and livestock. For instance, vegetated buffers along streams and drainages prevent raw livestock waste from entering waterways, instead providing for their conversion into rich soil.

Cultural Services

- Beauty of natural setting which contributes to local views and enjoyment
- Human health benefits of access to nature and opportunities for exercise
- Recreation and tourism opportunities
- Educational and scientific opportunities
- Spiritual and historical inspiration and activities; preservation of cultural/historical identity and sense of place



The value of access to beautiful natural public lands for recreation and for scenic views is widely acknowledged. A portion of this value can be estimated based on monetary benefits to the area via tourism and increased property values. Recently, the direct impact of access to nature on human health is also being explored. Most people know intrinsically that access to natural open areas makes them feel better. Open access to parklands encourages people to exercise and provides long-term health improvements and reduced health care expenditures (Batker et al. 2014). Recent psychological research suggests that spending time in nature improves cognition, relieves anxiety and depression, and boosts empathy (Hartig et al. 2014). The diverse outdoor environments of the SDC campus and undeveloped lands provide a wealth of opportunities for various recreational pursuits that positively affect the social, mental, and physical health of the human community. Exhibit 8 illustrates the distribution of current recreational facilities on the site.

The environmental education potential inherent in the property could provide significant enrichment opportunities and long-term positive impacts on how people understand and care for their landscape and its resources. The site is currently supporting scientific research (including mountain lion tracking by Audubon Canyon Ranch, and a study of wildlife use relative to recreational use led by Sonoma Land Trust) and could support other studies such as farming practices that support carbon sequestration; the use of prescribed burns to prevent high-intensity wildfires; or impacts of changing climate on Sonoma County wildlands.

Supporting Services

- Maintenance of genetic and biological diversity
- Nutrient cycling
- Photosynthesis/primary production

Supporting services provide the foundation for all other benefits we receive from nature, but are so fundamental that they are rarely quantified or monetized. Maintenance of biodiversity is one of these. Variation among individuals, populations, and species is the source material for the evolution of life on earth. Sonoma County is recognized as one of the most biologically diverse regions in California and the entire U.S., and SDC supports a cross-section of this diversity (CDFG, 2013; West Coast Watersheds and SEC, 2010). SDC's natural areas include most of the broad vegetation types found in the region. Its riparian woodlands along Sonoma Creek are an important link in an extensive north-south corridor. Its valley- and blue oak-dominated habitats are a remnant of historic woodlands now greatly diminished in the Sonoma Valley. Its extensive Oregon oak-dominated woodlands with their largely intact native understories are part of a larger network of oak habitat on Sonoma Mountain's flanks. Its mixed evergreen forests are similarly intact and connected to adjacent habitat. Its grasslands have a strong component of native species, an increasingly rare quality in Sonoma County and throughout California. On SDC, all of these habitats are connected to one another. This multi-dimensional connectivity is important not only for wildlife movement, but also for sustenance of biodiversity at the population level. Plants and animals must be able to move and disperse to exchange genetic material and adjust to changing conditions. The topographic diversity of the site also supports diversity. This diversity is a crucial tool in surviving changing conditions, like our changing climate.

Exhibit 8 illustrates the distribution of biodiversity across the site. This is a generalized ranking meant for illustrative purposes only and does not represent a definitive assessment of biodiversity on the site. The rankings were based on a combination of plant and wildlife values, considering the presence of native or non-native habitat, the plant diversity observed by PCI in the habitat type on site, and the potential for the habitat to support special-status species (or the known presence of such species).

Other supporting services that are so fundamental as to be almost invisible are nutrient cycling and photosynthesis. Nutrient cycling includes the capture of elements essential to life, like nitrogen from the atmosphere, converting it to forms usable by plants and animals, supporting agriculture as well as wild plants and animals. Photosynthesis is the process by which plants capture energy from the sun and convert it to stored energy, which humans and other animals require for sustenance.

Scenic Views

Sonoma Developmental Center plays a key role in the scenic beauty of the Sonoma Valley, which is deeply valued by local residents and regional visitors and is also enjoyed by tourists from around the world. Predominant views into and from the site are of open grassy hills, dark forested mountains, agricultural landscapes and historic architecture.

Motorists and cyclists passing through the property on Arnold Drive or Highway 12 can see sweeping vistas around the valley and up the full height of Sonoma Mountain. Along Arnold Drive, the large, stately shade trees lining the road provide a welcoming visual marker that you have entered the unique setting of the campus. The view into the campus from the main entrance at Harney Road and Arnold Drive is also picturesque, with a palm tree-lined avenue leading to the historic PEC building, which itself is framed to the back by the deep green, forested flanks of Sonoma Mountain. The limited development on the mountain, due to the land stewardship of SDC and protection of other adjacent parcels, is a key element in its unique appeal. Efforts by the local organization Sonoma Mountain Preservation and the county itself to ensure that development blend in with the surroundings visually have also helped preserve the mountain's visual character. As seen from Highway 12 and the Calabazas Creek and Montini Open Space Preserves, the SDC property forms a significant portion of the remaining contiguous natural vegetation still visible from across the valley.

View into the property from Harney Drive entrance to the southwest.

Within the campus, many internal roads are lined with mature, shapely ornamental trees. Many of these trees are eastern U.S. species not frequently found in Sonoma County or California settings, lending them added visual interest. The historic buildings add another layer of scenic and cultural interest.

Spectacular views of San Pablo and San Francisco Bays, Mayacamas Mountains and Sonoma Mountain that are normally reached through long, steep hikes, are easily accessed by short walks in rolling hills on the east side of the property. Climbing up into the hills of the west side, hikers can enjoy more sweeping views, as well as intimate views of intact woodlands and riparian corridors.

Both Highway 12 and Arnold Drive are designated by the Sonoma County General Plan (Sonoma County 2008) as scenic corridors. The property is also surrounded by Scenic Landscape Units designated by the

View to the east; Mayacamas in the distance.

View to the north from the south side of Fern Lake.

County; the Sonoma Mountains Unit to the west and the Sonoma Valley/Mayacamas Mountains to the east. The General Plan states that Scenic Landscape Units represent "natural features within Sonoma County that are highly scenic and of special significance. These landscapes have little capacity to absorb development without impacting the scenic value." See Local Regulations section below for discussion of the county policies that apply in these zones.

Recreational Facilities and Uses

The SDC site includes miles of trails and quiet roads that are highly valued by site staff, clients, and the public as well as other facilities that currently serve therapeutic and recreational purposes for clients. Public recreational use has generally been allowed by SDC, although it is not formally encouraged or facilitated (e.g., with trail maps or formal trailheads).

Roads and Trails

SDC includes a network of paved roads, unpaved access roads, and trails (Exhibit 5), as well as sidewalks within the core campus. Most of these are used by recreational users. The SDC property is popular with area casual walkers, hikers, dog walkers, equestrians, and mountain bikers. The public accesses the site's trails from trails on adjacent Jack London SHP and Sonoma Valley Regional Park, from Arnold Drive or from campus streets. Parking is possible along Arnold Drive or along SDC campus roadsides. Possible parking locations on west-side campus streets include the end of North Street, on Manzanita, and at the base of Orchard Road. On the east side, parking along Arnold Drive or Harney provides access to Suttonfield Lake trails.

Locked gate at base of Orchard Road.

Sidewalks and pathways on the main campus, although not currently heavily used except by locals and SDC staff and clients, offer pleasant walkways, with many mature, attractive shade trees and buildings of historical and architectural interest to view.

When both trails and access roads (which are used as trails) are considered, there are approximately 15.7 miles of dirt roads and trails on the approximately 758 acres of undeveloped land on site, or approximately 0.21 miles of trail for each acre. The network includes several routes that duplicate other internal routes or those on immediately adjacent parklands.

Table 5. Trail and Fire Road Distances

Location	Trails	Fire Roads
West of Arnold Drive	4.0 miles	5.3 miles
East of Arnold Drive	2.1 miles	4.3 miles

Paved Roads

The largest road on the property is Arnold Drive, which bisects the core campus. Arnold Drive is the only County-maintained road on the property. The remaining roads are owned and maintained by the State. The roads were repaved in the 1990s (Vanir, 1998). Within the core campus, there is a network of paved roads serving all of the residences and facilities. Sidewalks are present along most of these core campus roads, and they are generally in good condition. There is one road leading from the core facility to the west, Orchard Road. This road leads from the southwest corner of the core campus west for approximately 1.2 miles. A locked gate at the beginning of the road restricts access to only authorized vehicles, although it is frequently used by walkers. Orchard Road acts as the service road to the water treatment plant and several storage areas and ends at Camp Via. On the east side of Arnold Drive, pedestrians frequently access the eastern agricultural area of the property by walking along Harvey Street to Sunrise Street; this road segment has an existing bike/pedestrian lane and low traffic volume.

Harney Road connects the core campus with east side areas, and includes a bike lane.

Well-maintained access road, also used for recreation.

Access Roads

The unpaved access roads were originally graded and maintained to facilitate fire protection, access water tanks and other facilities, including the extensive agricultural landscapes that were once a thriving component of the SDC operation. These include the service road leading up and around Suttonfield Lake from Sunrise Drive on the east and Arnold Drive on the west, which together form a 1.8-mile loop. The Fern Lake fire road is approximately 0.75 miles and originates near Fern Lake off of Orchard Road and continues around the lake to the water diversion structure on Asbury Creek. Directly east of Arnold Drive and north of the Core Campus, an unpaved access road leads up a short rise to Suttonfield Lake. From there, a well-graded trail contours around Suttonfield Lake,

offering sweeping views down the valley.

Trails

The informal and formal network meanders through the undeveloped areas of the property east and west of Arnold Drive and the core campus. The trails extend from various points along the perimeter of the facility and from the unpaved access roads.

To the west of the Core Campus, the routes meander up through dense mixed woodlands and open meadows where quick elevation gains afford sweeping valley views to the east. Various routes converge toward Fern Lake where a trail circumnavigates the lake. From there, a trail traverses through the historic orchards, now part of the adjacent Jack London SHP, connecting to the greater network of trails and the historic features in that park, and beyond to the newly opened trails traversing the north and east slopes of Sonoma Mountain.

Some of the access roads and trails are very steep. Many have segments with 25% or greater slopes, including the Eldridge Fire Road and other trail segments leading up the western slopes. There are a few very steep segments north and west of Suttonfield Lake with up to 50% slopes. Some of these steep trails also have deep ruts from vehicle use in wet weather, uncontrolled widening, and/or significant erosion issues.

Trail Usage

Pedestrians, hikers, and dog walkers were observed on all visits, especially around Suttonfield Lake, on Orchard Road, and at Camp Via. Bicyclists and equestrians were also observed at lower levels. Dogs were frequently off leash, and were observed swimming with their owners in Suttonfield Lake. Dog droppings were abundant by the side of major trails. Dog use may be a significant source of contamination of local water supplies.

Steep access road used as trail.

Campus sidewalks provide appealing walkways.

Usage levels were not quantitatively studied for this effort, but information from the two adjacent parks, and online user applications, provides insight into potential use levels of SDC.

Based on Regional Parks data (SCRP 2017), recreational usage at Sonoma Valley Regional Park (which recently expanded from 92 acres to 162 acres) is steadily increasing, approximately 3-5% per year over the past 5 years. Over 50,000 people visited the park in most recent year.

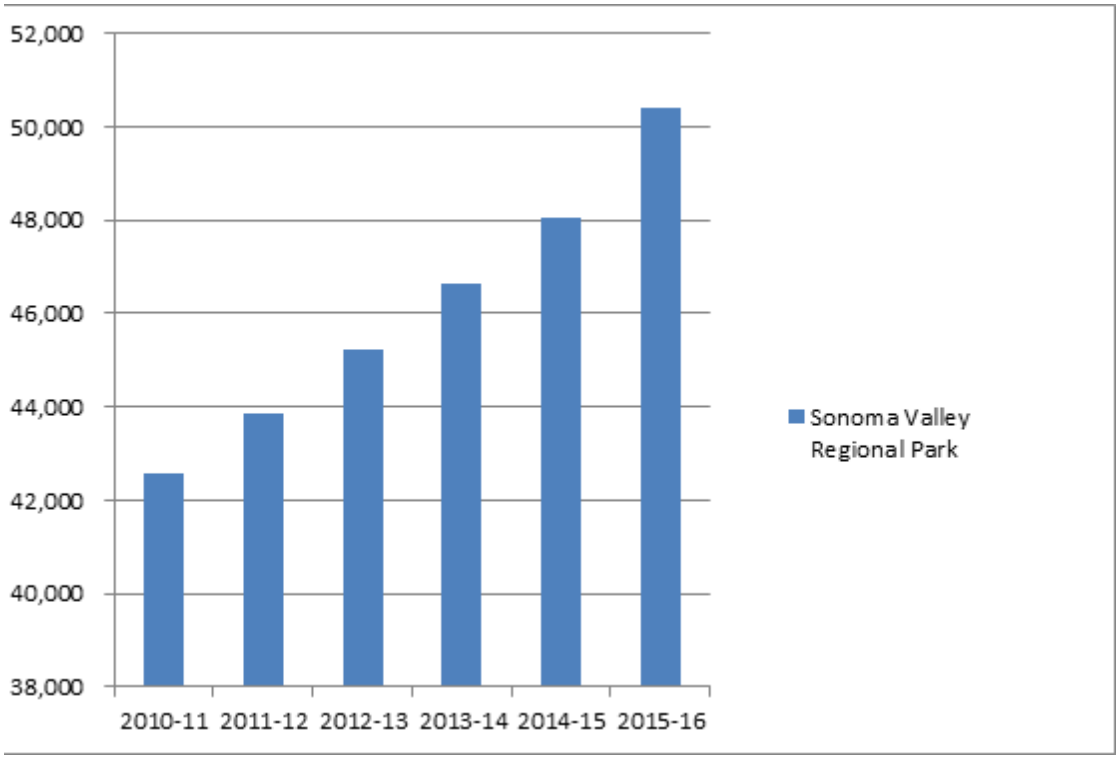


Figure 9. Numbers of Visitors to Sonoma Valley Regional Park, 2010-2016. Data courtesy of Sonoma County Regional Parks.

Jack London Park Partners, the non-profit organization currently managing Jack London SHP, estimates that approximately 80,000 people visit that park each year (van Wyk 2017). While the majority of their visitors come from California, they also receive visitors from around the U.S. and the world. The majority of the park's visitors come to learn about Jack and Charmian London and cultural and historical heritage. However, many visitors also come to use the trail system; approximately 1,000 of their annual visitors have annual passes, which suggests they are repeat users visiting to enjoy the trails on foot or by bicycle. In addition to the 80,000 annual visitors, approximately 15,000 people attend the Broadway Under the Stars performances of the Transcendence Theatre Company. Broadway Under the Stars is an outdoor summer theater program and fundraiser held in the historic ranch portion of the park.

Strava, an online recreation mapping and tracking application, also provides some insight into recreational use of the site. The maps below show routes recorded by Strava users (runners and cyclists) in and around the park. That data suggests that both user groups user Arnold Drive extensively, and both enter the SDC lands from Jack London SHP. Cyclists also appear to use Orchard Road frequently. Note that Strava users may not be representative of other user groups, like hikers or those who don't record their routes.

Figures 10, 11. Maps of 2015 use by cyclists (above) and runners (below) who recorded their path using Strava, an online recreation mapping application. Brighter blue and thicker lines indicate higher use levels. Relatively high cyclist use visible for Arnold Drive, Orchard Road, Camp Via area, and other connections into Jack London SHP. Relatively high runner use visible for Arnold Drive, trails around both lakes, and trails connecting to Sonoma Valley Regional Park and Jack London SHP. Many users appear to enter from Jack London. Maps from Strava.com.

Trail Signs

Trail directional signage of a variety of formats, vintages, and states of repair is present in scattered locations. Signage indicating use limitations is present, especially around the lakes. Several memorial trail signs are present throughout the property, a testament to the fact that the public considers the property de facto public open space, and has strong feelings of connection to the property.

Signage indicating trail closures during wet conditions, above, and dog restrictions, below.

Some of SDC's trails are imbued with local meaning and history, like the Carolyn Day Trail commemorating a local equestrian (above) and leading to a beloved old growth redwood on adjacent Jack London SHP (below).

Connections to Adjacent Lands

Sonoma Valley Regional Park

Currently there are many informal access points into the Regional Park to the north, including links to the Northwest Ridge Trail, the Frog Pond Fire Road, and the Northeast Ridge Loop Fire Road (see Exhibit 5). Some of these trails and access points may be redundant and could be considered for consolidation and decommissioning if the east side of SDC becomes formal parkland in the future. New planned trails along the southeastern portion of Sonoma Valley Regional Park will also bring new visitors along the eastern boundary of SDC, with a view into the SDC agricultural area and wet meadow. There is currently fencing in place that would serve as a deterrent to trail users wandering off trail onto SDC, but determined visitors could readily cross that boundary and create new social trails.

Jack London State Historic Park

Camp Via and Coon Trap Trail lead from Camp Via to the west onto Jack London SHP. Coon Trap Trail leads to the Sonoma Ridge Trail, part of the Bay Area Ridge Trail. Sonoma Ridge Trail extends 8.6 miles from the North Sonoma Mountain Regional Park and Open Space Preserve south to the Eliot Family Loop Trail. Fern Lake Trail leads from Fern Lake to the west; connects with Vineyard Trail, which leads to the main park entrance, key park historic features and museum. No dogs are allowed on park trails.

Proposed Sonoma Valley Regional Trail

Regional Parks has completed a feasibility study (Questa 2016) and is now seeking funding for this project, which would include a paved trail extending 13 miles from Santa Rosa to Sonoma. The feasibility study estimated the total cost of the trail to be about $24 million. The SDC segment would follow SDC's eastern boundary, parallel to Highway 12 (see below). The SDC segment is part of the Agua Caliente Road to Sonoma Valley Regional Park section, which is identified as a Phase 1 Priority project by the Feasibility Study. One small section of this segment, in the Agua Caliente area, has already been funded and is under construction.

Generally, the trail design would include an 8-feet wide paved trail with two 2-foot gravel shoulders on one side of the highway for the entire project length except for the Kenwood area. The 8-feet trail width allows for two-way bicycle and pedestrian traffic. Regional Parks prefers that the trail be set back from the road as far as possible within the public road right of way, to provide a more pleasant trail user experience. The trail would typically have a 5 to 7 feet separation from the road shoulder. The separation could include a landscaped buffer strip. In locations where space is limited due to insufficient public right of way or environmental constraints, the trail separation could include a physical barrier such as a guardrail.

The alignment of the trail along SDC is recommended for the west side of Highway 12. The current conceptual alignment roughly follows existing SDC dirt access roads. If the regional trail is developed, users would likely access the SDC site via the existing dirt roads in that vicinity and connecting John Mesa Drive.

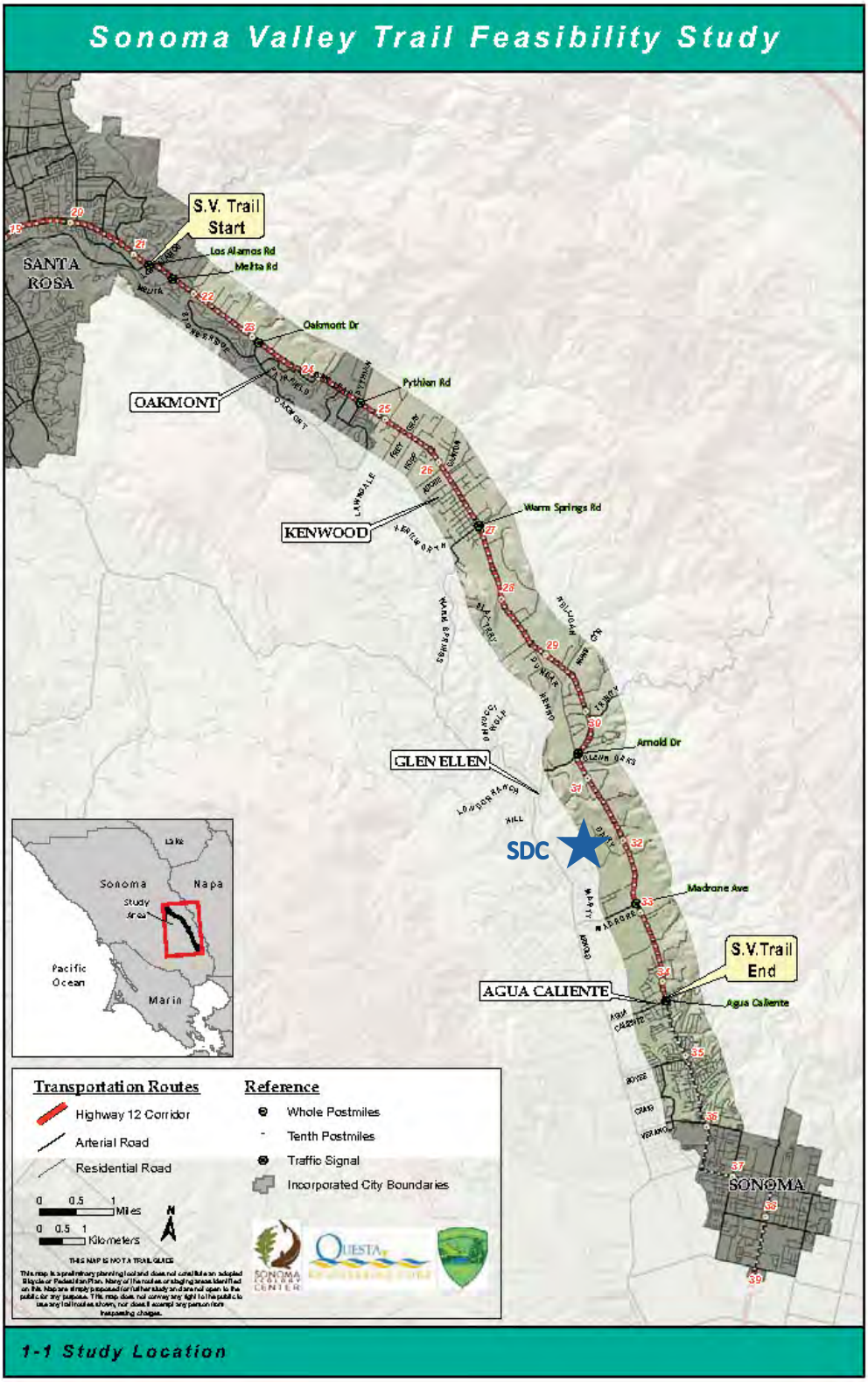


Figure 12. Proposed Sonoma Valley Regional Trail. (Questa 2016).

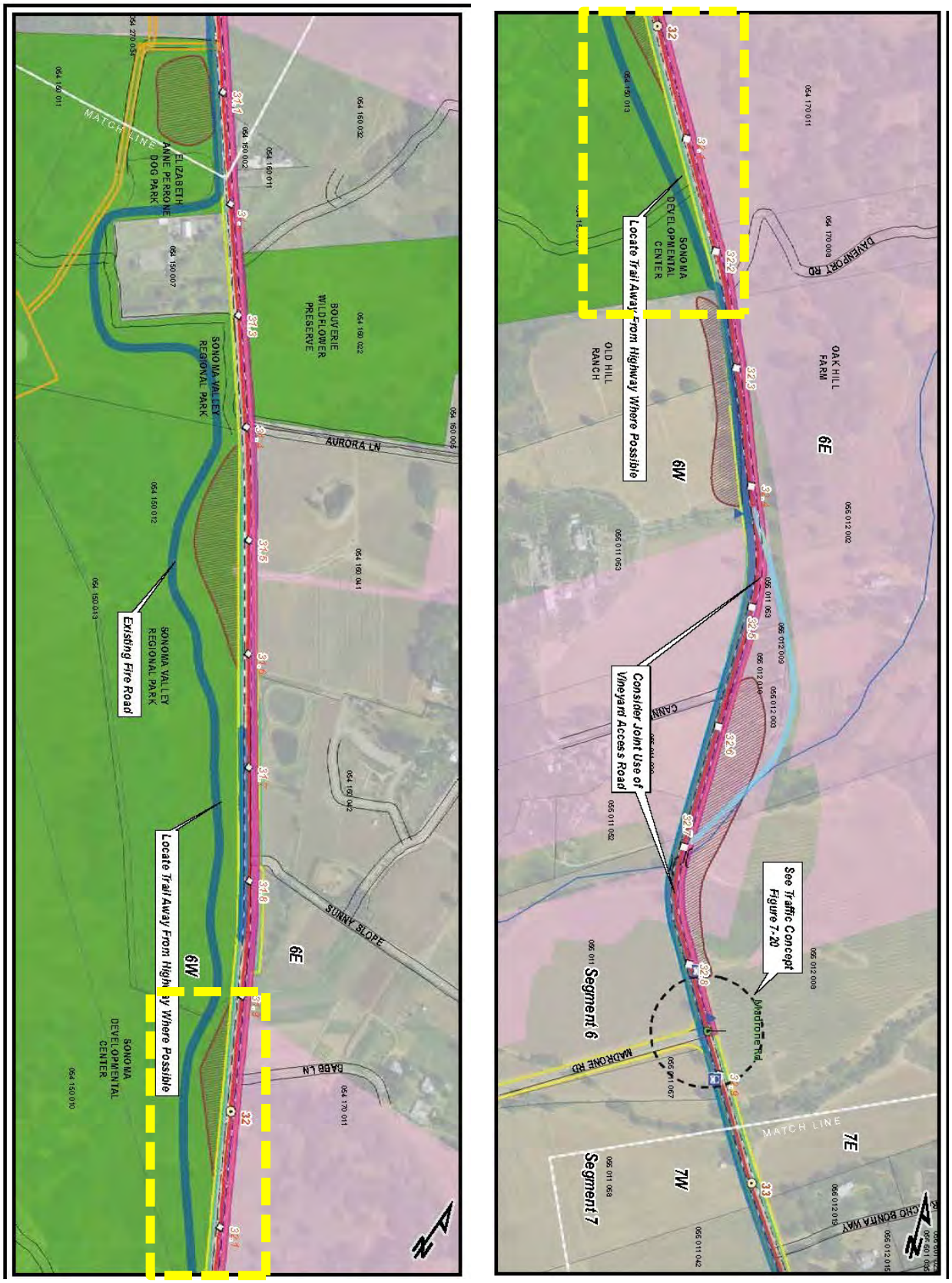


Figure 13. Sonoma Valley Regional Trail, proposed alignment (solid blue line) in SDC vicinity (Questa 2016). SDC portions highlighted with yellow dashed boxes. On left is northern section; on right is southern continuation. Figure notes "Locate trail away from highway where possible."

Proposed Sonoma Valley-Eldridge Bikeway

Local resident Arthur Dawson has developed a conceptual plan for a bikeway allowing for safe and easy travel (Dawson 2017). See Exhibit 5 for proposed trail alignment.

Extending approximately four miles north from Madrone Road, the bikeway would link residential neighborhoods to downtown Glen Ellen, Dunbar Elementary School, SDC, Sonoma Valley and Moran-Goodman Regional Parks. Dawson notes that the bikeway would provide people living in neighborhoods along the route safe, non-motorized access to shopping, commuting, recreation, and transit stops. The many visitors to the area could also use the path for recreation, sight-seeing and wine tasting.

The proposed route incorporates an existing bike path on county property, a railroad grade on state property (SDC), quiet side streets, and a paved bike path on an existing easement. Except for a very short section in downtown Glen Ellen, the bikeway avoids heavily traveled roads. The bikeway is already usable, though two barriers restrict easy passage. The creation of the Glen Ellen-Eldridge Bikeway would not require widening roads for bike lanes, or acquiring easements on private property. Suggested steps to improving the bikeway conditions include, in approximate order of complexity:

- Removing a metal rail next to the gate at the SDC end of the old railroad grade to allow easy bike and pedestrian access
- Opening the gate between SDC and Burbank Drive; issues with past vandalism at SDC will need to be addressed
- Installing a crosswalk at Madrone Road
- Providing a 100-foot link between Burbank Drive and SDC paved road
- Removing the gate between the Regional Park and SDC, which has been open for years
- Providing a durable surface between the Regional Park and SDC
- Installing signage identifying the route

The Glen Ellen-Eldridge Bikeway could serve as both a local route and as a link in the regional system envisioned in the Sonoma County Bicycle & Pedestrian Plan (2010). The planned Sonoma Valley Regional Trail would be just over a mile east of this proposed Bikeway; connecting the two would bring additional benefits to cyclists.

Scenic Lakes and Creeks

In addition to providing water storage and serving as important wildlife habitat, the two lakes on the property are also recreational features serving as destinations for hikers and equestrians, providing scenic views and opportunities for wildlife observation. As described above, a combination of trails and unpaved access roads encircle both of the lakes. Although swimming, fishing and other aquatic activities are prohibited for water quality, safety, and liability reasons, the trails around the lakes are well used and visitors and their dogs have been observed swimming.

Fern Lake is located at the upper slope of the west end of the property and is surrounded by mixed evergreen forest area and grasslands. It is possible to circumnavigate the lake using a combination of nearby trails and unpaved access roads, and views vary from open water to surrounding forest. Due to its relatively remote location on the property, Fern Lake receives fewer visitors than Suttonfield Lake on the east side, and because of its proximity to Jack London SHP, is often accessed by people on long hikes or rides from adjacent lands.

Suttonfield Lake, the larger of the two water bodies, sits at a slightly lower elevation between Arnold Drive and Highway 12 to the south of Sonoma Valley Regional Park. Due to its proximity to Arnold Drive and roads, Suttonfield Lake receives a much higher level of use than Fern Lake. The trails around the lake are frequented by hikers, runners and dog walkers, and to some degree equestrians and bicyclists. During weekday evenings and weekends, the use in the greater Suttonfield Lake area appears similar to SVRP (Ehret, 2015).

Fern Lake prohibitions.

Warning signage at Suttonfield Lake dock.

Rope swing remnant, a relic of past recreational use at Suttonfield Lake.

Visitors have modified rule signage to show their preferences.

In addition to the lakes, three creeks on the property support passive recreation serving as destinations for hikers, equestrians, and bicyclists, and opportunities for wildlife observation. While Sonoma Creek is limited with no formal trails or access points, views and sounds of the creek are available at numerous points including bridge crossings. Nearby trails and unpaved access roads interface with Asbury and Hill Creeks offering seasonally available views and sounds of running water.

Equestrian Facilities[6]

Historically, the complex of barns, out-buildings and paddocks along Sunrise and Dairy Roads were a part of the extensive agricultural use of the SDC property. While many of the structures remain underutilized or have been converted to storage or other uses, the Eldridge Equestrian Center operates out of one of the central barn structures and maintains the actively used riding ring facility. A number of the other barns and several of the paddocks are well used by the community for boarding horses.

Table 6. Equestrian Buildings

Building	Year Built	Current Use	Square Footage
Horse Barn	1948	Horse barn – horses belong to SDC employees	7,500
Horse Barn/Tack Room	1950	Horse barn- horses belong to SDC employees	4,800

[6] Area impacted by the Nuns Fire of October 2017; post-fire status not evaluated.

Building	Year Built	Current Use	Square Footage
Jr. Farm Area – Old Slaughter House	1950	Vector control storage – empty (building condition poor)	1,378
Jr. Farm Feed Barn	1939	Farm, animals	4,616
Jr. Farm Shed	1939	Farm	308
Jr. Farm Storage Shed	1950	Farm storage	924

The equestrian facilities also support a therapeutic riding program for patients of SDC. Therapeutic riding gives students with disabilities the ability to control a horse as well as one's own body to increase balance, muscle control, concentration, and patience, while instilling responsibility, and teamwork.

Equestrian facilities.

Eldridge Farm[7]

The Eldridge Farm, formerly known as the Junior Farm, has been in existence since the late 1960s. SDC staff recognized the potential benefits that the relationship between individuals with developmental disabilities and animals provides, a relationship that fosters personal and social growth, and environmental awareness, as well as unparalleled enjoyment. SDC residents work shifts at the farm and benefit not only from interacting with the animals, but with the public that visits the farm. In a recent survey of parents of SDC residents conducted by Regional Parks, the Farm ranked as the most favorite outdoor area (SCRP, 2014).

Horse corral.

In the past, there were "over 100 animals that lived at the farm including llamas, a

[7] Area impacted by the Nuns Fire of October 2017; post-fire status not evaluated.

variety of goats, pigs, ducks, geese, miniature horses, donkeys, Amazon parrots, cockatiels, chinchillas, chickens, roosters, rabbits, cats, guinea pigs, fish, pet rats and a turkey. There are plenty of picnic tables and 6 zoo-like voice boxes scattered throughout the farm to educate visitors about the animals and their habitats" (PHA 2015). The area currently accommodates horses belonging to SDC employees and local residents, and other small farm animals including miniature horses, llamas, donkeys, and birds. There is an outdoor horse arena next to the farm buildings. In the past the farm received active visitation from SDC residents and the community; many local elementary schools and group homes visited the farm. The number of animals still residing at the farm has dwindled over the years as has visitation by outside groups. The farm is open every day from 8 a.m. to 4:30 p.m. Entrance is free, but donations are accepted, and the facility is wheelchair accessible.

Softball field.

Athletic Fields

There are two athletic field areas on the SDC property. The first is the softball field on the northern edge of the main campus adjacent to Arnold Drive. The well-maintained field is lighted and is used by local organizations and clubs as well as informally by the local community. The fields are easily accessible from Arnold Drive and are a valuable asset for SDC and the greater community. Associated features include five bleachers, a chain-link backstop, several benches for team members next to the backstop, field lights mounted onto wood utility poles, and a cast concrete water fountain.

John Mesa Park soccer fields parking area.

The second field area is located in the southeast corner of the property and contains two soccer fields. Otherwise known as John Mesa Park, these fields were developed in 1984. The park-like setting consists mostly of open grass fields with gently rolling terrain and includes a long, low barn structure and several mature oak trees. The area has been a popular destination for more able-bodied SDC residents on walks and as well as for employees on break. At one time these fields were used for organized soccer games. These fields previously hosted occasional informal soccer play by the community. A gravel parking area west of the field accommodates approximately 25 to 30 cars.

Storage shed and mural at John Mesa soccer fields.

Camp Via

Camp Via is located approximately 0.6 miles west of the Core Campus at the end of Orchard Road. It is now surrounded by Jack London SHP and is adjacent to the historic orchard that was once part of SDC. Camp Via is a 40-bed camping facility built in 1961 that at one time provided outdoor activities for residents and staff. There is a well that serves Camp Via, independent from the water system servicing the rest of the facility. Camp Via includes:

- Camp Via Employee Restroom (72 sf)
- Camp Via Employee Picnic Restroom (384 sf)
- Camp Via Shower Room (320 sf)
- Camp Via Dinning Hall (1,560 sf)
- Camp Via Restroom #1 (320 sf)
- Camp Via Restroom #2 (320 sf)

Currently, Camp Via is used as an occasional day-use destination by SDC residents and staff, but not as an overnight retreat. The camp is also used by trail users for resting, refilling water, picnicking during hikes and horseback rides on the nearby trails, and as a destination for people walking or riding their bikes up Orchard Road. The main dining hall is the only building which appears to be in functional condition. Other facilities which are in disrepair include seven cabins, barbeque pits, a small amphitheater, a water tower, a wheelchair swing and wading pool.

Camp Via main dining hall.

A large population of western rattlesnakes is present at the main hall entrance and around other concrete areas where snakes warm in the sun. According to SLT, this area is used extensively by mountain lions. These wildlife occurrences could pose a safety hazard. In addition, there are a number of very large mature oaks surrounding the camp, one of which fell onto the cabins. A tree hazard assessment would be beneficial prior to future uses. Weedy, disturbed vegetation including Himalayan black-berry and Italian thistle is present around the buildings.


Camp Via cabin.

Ropes Course

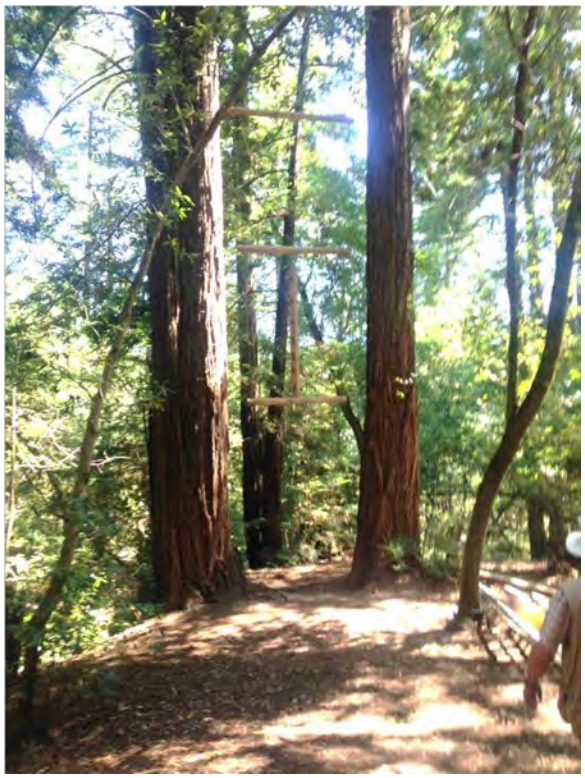
The privately operated Challenge Sonoma Adventure Ropes Course is operated on the SDC grounds off of Orchard Road on the way up to Camp Via, along upper Hill Creek. The non-profit group has maintained and operated the course since 1984 to support school children and youth-at-risk in the Sonoma Valley. The ropes course facility provides experiential training, challenge courses, teambuilding, corporate events and wilderness adventure to a variety of groups.

The course was originally established through the University of California's 4H Extension office in cooperation with the state (Diana Rhoten, 8/2017). In 2000, 4H ended their participation and Challenge Sonoma was established as a 501(c)3 non-profit organization to continue management of the course. The course was rebuilt at that time to meet current safety standards and private insurance requirements.

Currently, 60-70 courses are offered per year, in addition to 8 days of training. 80% of the attendees are from school groups such as the City of Sonoma's Youth and Family Services program, sports teams, and university orientations. Occasional corporate groups also participate. Each course typically serves 30 students and lasts 4-6 hours. In total, approximately 1,400 people participate per year. Participants typically arrive by carpool or bus to the meeting point at the cargo container holding Challenge Sonoma gear, located near the course. Challenge Sonoma also incorporates environmental awareness into their programs; many of the students attending have never before been in a redwood grove.

The site is inspected twice a year to ensure compliance with standards set by the Assocation of Challenge Course Technology, as well as OSHA requirements. Challenge Sonoma also does inspections prior to the start of each course. Challenge Works of Santa Cruz builds and does repairs to the course elements. Small additions have been made to the course since 1985. Diana Rhoten, executive director, noted that the organization prefers to work with relatively small groups and is not interested in expanding substantially.

The course extends along the creek, in forest dominated by redwoods, madrones, and bays. According to Rhoten, the course is designed to prevent damage to the trees used for course supports. Some soil compaction and loss of understory is evident within the course. Addition of mulch for soil protection has been considered but not implemented out of concern for loss of materials into the creek. Small seeps are present at the upper end of the course that flow across the course trail; informal small diversions have been made with rocks to keep the trail drier and prevent erosion. A native American grinding rock is present adjacent to the course's main stream crossing.



Ropes course elements.

Ropes course elements.

Trail to course, crossing over Hill Creek.

Stairs to ropes course elements.

Other Recreational Resources

A number of other resources are present on the site, including:

- Butler Pool and Bathhouse (1950 sf). Located on Railroad Drive, the pool includes equipment to provide accessibility for users with limited mobility. Restrooms, showers, and an equipment room are also present.
- Old Employee Picnic Area. This is an open area between Fern Lake and the ropes course, which includes picnic tables, a BBQ pit, dancefloor, and an employee restroom; these are in disrepair. The area is currently used as a staging area for Challenge Sonoma's ropes course.
- Carousel. This carousel was built in 1918 and renovated approximately 7 to 9 years ago, but it has not been used by the facility since children were being treated in the 1980s. It is currently located on Palm Street.
- Oak Valley School Gym. This small gym includes an indoor basketball court.

BBQ Pit at employee picnic area.

Signage and open area set aside for employee picnic area and parking.

Butler Pool.

Above and below: historic carousel.

Human Impacts

This section provides a brief overview of the primary impacts that human activities at SDC have had on the site's resources in the era of European settlement. Considering these historic changes during the conceptual planning process may help identify opportunities for enhancement or future strategies for protecting natural resources. Climate change is discussed separately; see Climate Resilience section below.

Dense stand of invasive broom along trail.

Campus Development and Roads

- Habitat has been lost to development on the central campus. The core campus likely supported oak woodland and a wider riparian corridor along Sonoma Creek in the past.
- Wildlife movement has been limited by loss of habitat, human presence, and roadways through campus.
- Development close to Sonoma, Asbury, and Hill Creeks and the hardening of banks in some locations to protect structures has likely resulted in flashier streamflows and has limited the ability of streams to shift naturally over time. This in turn decreases riparian corridor widths, infiltration, and habitat values.
- Construction of impervious surfaces increases the speed of water running off from the site, decreasing the infiltration of water into soil and ground-water.
- Road construction and other clearing have probably increased rates of soil erosion and sedimentation into streams.

Deep ruts and erosion along an access road.

- Invasive plant species have been introduced and spread along access roads and through disturbed edges of development adjacent to open space. For example, along some roads and at the dams, dense invasive species (yellow starthistle and broom) infestations are common.

Yellow starthistle in grassland.

Agriculture and Timber Harvest

- Historic timber harvest removed old-growth trees, and may have destabilized soils in some areas; forests have re-grown but are likely different in structure and composition than they were previously. In some locations that appear to have been cleared of oak woodland or savanna, oaks have not regenerated.
- Native grassland species have been lost from most of the SDC grassland and wet meadow, replaced primarily by non-native European species. This was probably driven in part by historic livestock ranching and the introduction of European plant species, processes which occurred throughout California.
- Development of drainage channels, including through the wet meadow, may have reduced water availability to the meadow and increased the speed of runoff, which may in turn have reduced groundwater recharge and changed meadow plant composition.
- Long-term livestock use appears to have reduced the regeneration of native trees, especially oaks on the east side of the property.

Water Use

- Development of Fern Lake and Suttonfield Lake resulted in the loss of historic native habitats in those locations, and also introduced lake and wetland fringe habitat which supports both native and non-native plants, fish, birds, and invertebrates.
- Water withdrawals from the creeks and wells reduce winter flows and influence local groundwater supplies. With the water rights restrictions in place, current flow regimes appear adequate for fish, but historically larger winter flows may have provided more opportunities for fish movement during higher flow conditions.
- Water diversion structures constructed in the creeks and springs resulted in the loss of habitat, restrict fish passage, and may restrict wildlife movement up- and downstream.
- The impoundment of the small pond on the east side appears to reduce water availability to the wet meadow below, as do drainage ditches around the meadow.

Recreation

- Native vegetation has been removed for development of trails; soil has been compacted by recreational use, and invasive plant species have been spread and established in the disturbed terrain along trails.
- Development of trails and the presence of people (including at Camp Via) have influenced wildlife use. The effects of recreational trail use on wildlife are complex, vary by species, and are the subject of ongoing study. Currently, levels of recreational use on the site appear to be relatively low compared to adjacent formal parklands, but levels would be expected to increase if parkland is established in the future. Even at current use levels, wildlife populations have probably adjusted their movements and habitat use to avoid humans.
    - Higher levels of human usage have been linked to reduced carnivore (i.e., mountain lion, coyote, bobcat, and gray fox) abundance in a North Bay study (Reed and Merenlender 2011).
    - Another recent Bay Area study (Reilly et al. 2017) did not find this overall reduction, but did find that coyotes and mule deer were more active at night in areas with higher recreational use.
- The presence of dogs has likely influenced wildlife use.
    - Dogs frequently chase wildlife, resulting in direct predation, injury, or stress to wildlife. They can also spread disease to wildlife. Their deposition of scent and waste may cause avoidance by other species. Off-leash dogs generally have higher impacts than leashed dogs.
    - Dog presence has been shown to be correlated with lower bird species diversity and abundance (Banks and Bryant 2007), and to reduce activity levels in deer, small mammals, and bobcats (Length et al. 2008). A recent Bay Area study found reduced habitat use by mountain lions where dogs were present (Reilly et al. 2016).
    - Dog waste may reduce water quality in nearby streams.
- The development of the ropes course has altered riparian and redwood habitat along Asbury Creek.
    - Understory vegetation has been lost and soil is compacted. These factors may increase the rate of precipitation runoff from the site and decrease infiltration into the soil.
    - Challenge Sonoma undertakes regular tree inspection to prevent damage to trees, and to ensure safety of the course. Tree health currently appears good, but compaction of soil and use of trees for course elements may result in long-term stress to trees. Drilling into trees to place cables creates a wound in the tree which can be an entry point of infection. Redwoods have strong natural disease resistance but are not invulnerable to fungal infection. Cabling around trees can constrain tree growth unless adjusted regularly.

Loss of understory and soil compaction in Ropes Course.

Attachment of stairs to redwood.

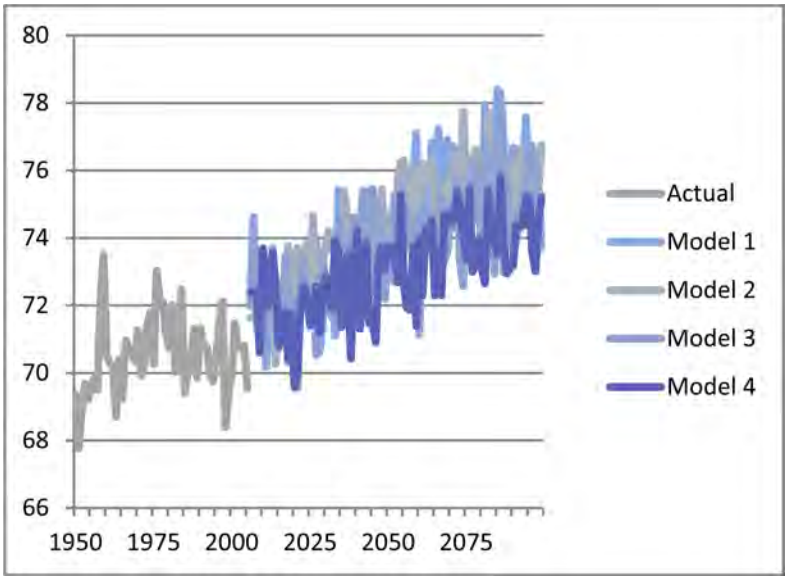
Climate Change and Resilience

The North Bay Climate Adaptation Initiative projects that Sonoma, Marin, and Napa counties "should anticipate summer temperatures increasing by approximately 6 to 8°F, on average, in our region by approximately the end of the century…with a likelihood of an increase in the frequency and intensity of extreme events such as droughts and floods" (NBCAI, 2013). These changes are likely to have a cascade of effects on people and natural systems at SDC and the Sonoma Valley, including:

- Higher demand for groundwater pumping and surface water diversion due to either lower total precipitation or extreme, short duration storm events with more runoff and less rainwater infiltration
- Declines in plant and wildlife species that are less tolerant of drought conditions and higher temperatures
- Changes in the varieties or types of crops that can thrive in our area
- Increased fire risk. Wildfires like the Nuns Fire of October 2017 are likely to occur more frequently.
- Changes in pests and disease vectors due to reduced frost frequency

Average annual maximum temperatures

Glen Ellen area



Cal-Adapt (2017)

Extreme Heat Days

Glen Ellen area

Extreme Heat threshold:

103.9° F

Average number of days with high above threshold in 1961-1990:

4.3

Average number of days with high above threshold in 2070-2099:

24

Cal-Adapt (2017)

A resilient ecosystem is one that is resistant to change from outside forces, and/or is able to recover rapidly from disturbance. In its current state, with extensive open space, SDC has significant capacity to contribute to the region's resilience to ongoing climate changes. The site's water resources, intact native habitats across a range of elevations, and connectivity to other protected lands are key to this resilience.

Resilience Resources: Water

SDC's abundant water resources and dense riparian vegetation can moderate water temperatures in the reaches of stream on the property and create thermal refuges. The plant communities on the property sequester carbon from the atmosphere as well as provide cooler temperatures for heat-stressed animals

through shade and evapotranspiration. Were they to be replaced with driveways and buildings, the property's capacity to help wild species adapt to climate change would be significantly diminished while the problem that creates the need would be intensified.

Resilience Resources: Topographic Diversity

Under variable climatic conditions, areas of high landscape diversity have been found to be important for the long-term population persistence of plants, invertebrates, and other species (Anderson et al. 2014, Timpane-Padgham et al. 2017). The topographic diversity of SDC's landscape, with elevations ranging from valley floor to upper slopes of Sonoma Mountain, and a range of landforms, aspects, and cover types, offers local-scale thermal options to plants and wildlife, buffering them from changes in the regional climate.

The best historical analogue for the ongoing rise in global temperatures occurred 55 million years ago, when the average global temperature rose 5–6 ◦C in 10,000–20,000 years.

At that time, species' ranges shifted and subtropical cypress swamps, complete with alligators, existed on Ellesmere Island in the Arctic.

A similar rise in temperature has been projected within the next 100–200 years, two orders of magnitude faster than previous warming events.

Krosby et al. 2010

Resilience Resources: Connectivity

Habitat connectivity supports climate resilience by allowing species with ranges large or small to move or shift over time to find cooler temperatures, moister soils, or to follow plant and insect populations as they also adapt to changing conditions (Timpane-Padgham et al. 2017).

A recent study of SDC's value for maintaining wildlife connectivity along the Sonoma Valley corridor analyzed expected rates of climate change and the distribution of climates across space to help assess the relative importance of the SDC corridor in climate adaptation (Gray & Merenlender, 2015). Because of its topographically diverse habitats, and its connection to more coastal climates, they found that the SDC corridor is likely to be particularly valuable in terms of access to cooler areas, slower rates of change, and greater climatic diversity compared to other similarly sized linkages in the North Bay. They determined that in recent decades (1951-2010), the corridor has provided between 1.52 to 1.59^{o}C cooling during the summer. Based on their modeling of future conditions (2070-2099), the corridor is estimated to provide access to cooler coastal areas that are between 1.02 to 1.06°C cooler in summer. They also determined that the SDC corridor is likely to provide a relative reduction in the velocity of climate change of 0.11 km/year relative to California in general. Also due to its topographic diversity, the SDC corridor will provide important climate diversity, which they measured in terms of climatic water deficit.

Potential Vegetation Changes

Understanding how plants and wildlife are responding to climate change is an emerging area of study, with many complexities and unknowns. Some forecasts have been made for how expected future conditions will fit with the habitat needs of dominant plant types. However, the timing and mechanisms for vegetation community shifts are complex at a local scale and difficult to forecast. In general, the Bay Area climate is becoming more conducive to shrub-dominated vegetation and less conducive to montane coniferous vegetation. Researchers have made forecasts of likely vegetation changes on Sonoma Mountain (NBCAI 2017). These include:

- Expansion of California bay and chaparral
- Declining Oregon oak and grassland. Oregon oak is already near the southern limit of its

distribution here. Recruitment failure has already been observed in some populations, though causes are uncertain.

- Stable populations of coyote brush, coast live oak. Douglas-fir may be stable or declining.

The researchers note that "these changes may occur slowly over many decades (or even centuries!), as long-lived trees eventually die off, and are replaced by other species. Major disturbance events, such as fire or drought-related tree mortality, may speed up these transitions. Seed dispersal, the way a plant produces and spreads its seeds, will be a key factor that may limit the expansion of well-adapted species or favor invasive weeds as conditions change, particularly after a major disturbance." The Nuns Fire of October 2017 may be an example of a "major disturbance event" for some vegetation in the SDC vicinity.

See Figure 9 for NBCAI's (2017) forecast of changes in suitable conditions over time for each of the Sonoma Mountain region's current vegetation types.

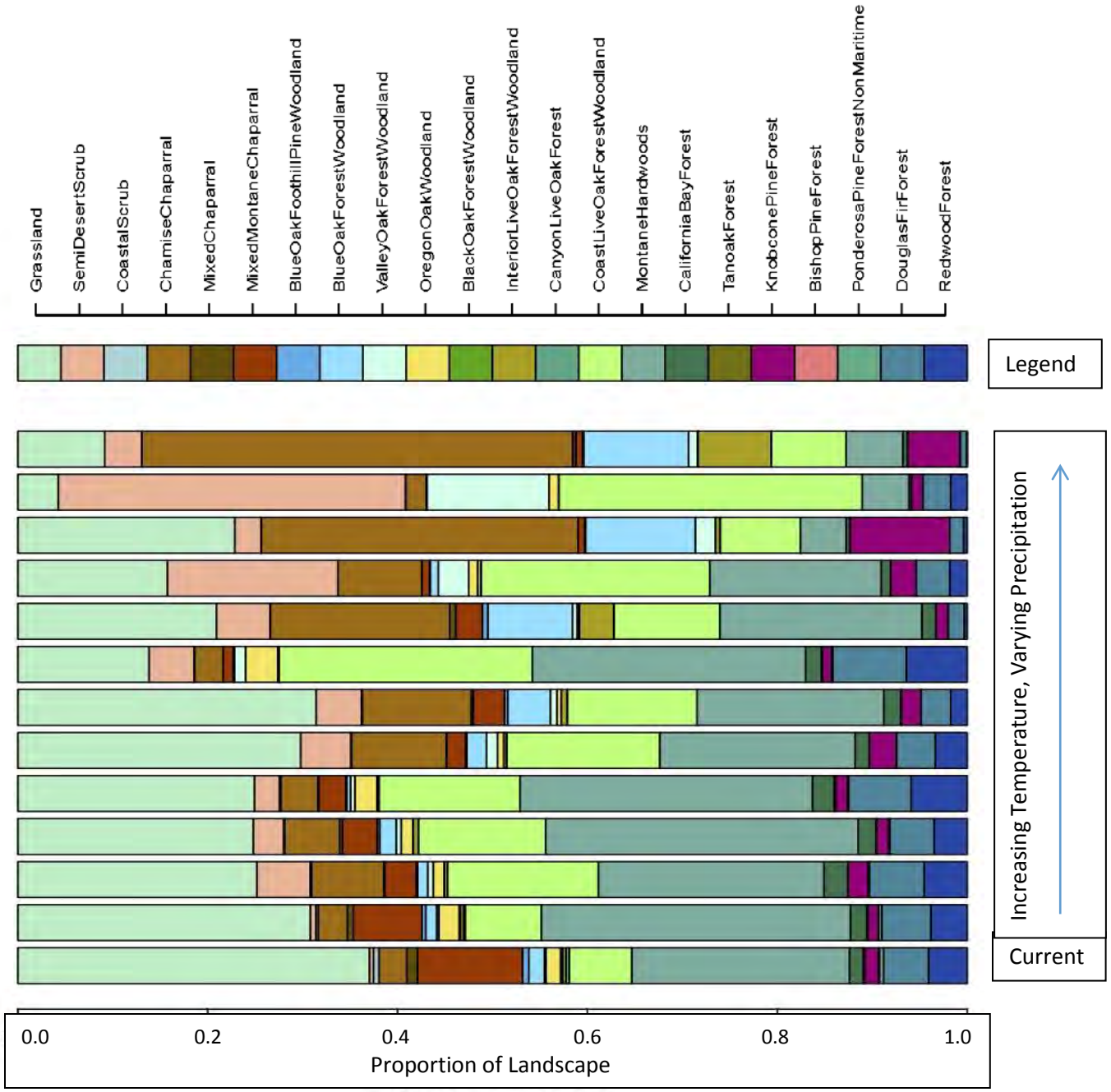


Figure 9. From NBCAI (2017). Forecasted changes in extent of habitat suitability for Sonoma Mountain vegetation types with climate change. Each color represents a different type of vegetation (see legend, top row). The lowest bar in this stacked chart represents current proportions of land cover. As you move up the stack, future temperatures increase, precipitation varies, and the resulting relative area of climate suitability for each vegetation type is shown. The hottest temperature (second bar from top) represents an increase of 5.67 degrees C and precipitation decline of 191 mm.

Regulatory Jurisdictions and Policies

A number of state and local plans and policies govern land use and development on the SDC property. Future development and land use changes on SDC would be subject to a range of local, State and federal regulations. This section includes a description of applicable regulations and the agencies responsible for enforcing the regulations. The list is not exhaustive and additional regulations may apply. This discussion does not include a list of general local, State, and federal regulations, only those with specific mention of SDC or those that are clearly relevant given the known resources on the property.

Local Regulations

Sonoma County General Plan and Local Zoning

California planning law (Government Code Sections 65302–65303) requires each city and county within the State to develop and adopt a general plan. General plans are long-range policy documents to guide the use and future development of private and public lands within the boundaries of a city or county.

The Sonoma County General Plan (General Plan) is the blueprint for how land is used in unincorporated Sonoma County, and it sets forth the County's official position on issues, such as development and resource management (PRMD, 2008). The General Plan establishes policies for regulating new development projects within the unincorporated portions of the County. These policies are then translated into implementation tools (such as the zoning ordinance, subdivision regulations, and design guidelines) to assure that the County's vision is implemented. Policies set forth in the plan guide decisions about the conservation of resources within the county. The zoning ordinance is the primary tool used to implement General Plan policies. In contrast to the long-term outlook of the General Plan, zoning classifies the specific, immediate uses of land. SDC is located in General Plan Planning Area 9, Sonoma Valley.

The four Sonoma County Assessor's Parcel Numbers comprising SDC (APNs 054-090-001, 054-150-010, 054-150-005, and 054-150-013) are currently designated Public/Quasi-Public in the County General Plan. The table below shows the land use designation and zoning for each parcel.

Table 7. Parcel Land Use and Zoning Designations

APN	Land Use Designation	Base Zoning	Combining District
054-090-001	Public/Quasi-Public	PF/B7	F2 HD LG/MTN RC50 SR VOH
054-150-005	Public/Quasi-Public	PF/B7	F2 RC50 SR VOH
054-150-010	Public/Quasi-Public	PF/B7	RC50 SR VOH
054-150-013	Public/Quasi-Public	PF/B7	RC50 SR

The base zoning for each parcel is PF B7 which means that the parcels are zoned Public Facilities (PF) and restricted from further subdivision (B7). The combining districts vary by parcel: 100 year flood hazard area (F2), historic resources (HC), scenic resources (SR), local area development guidelines (LG/MTN), riparian corridor 50 feet (RC50), and/or Valley oak combining district (VOH). If uses other than public facilities were to be proposed for the property, a change in land use designation and General Plan amendment would be needed.

General Plan elements that may be relevant to the property are as follows:

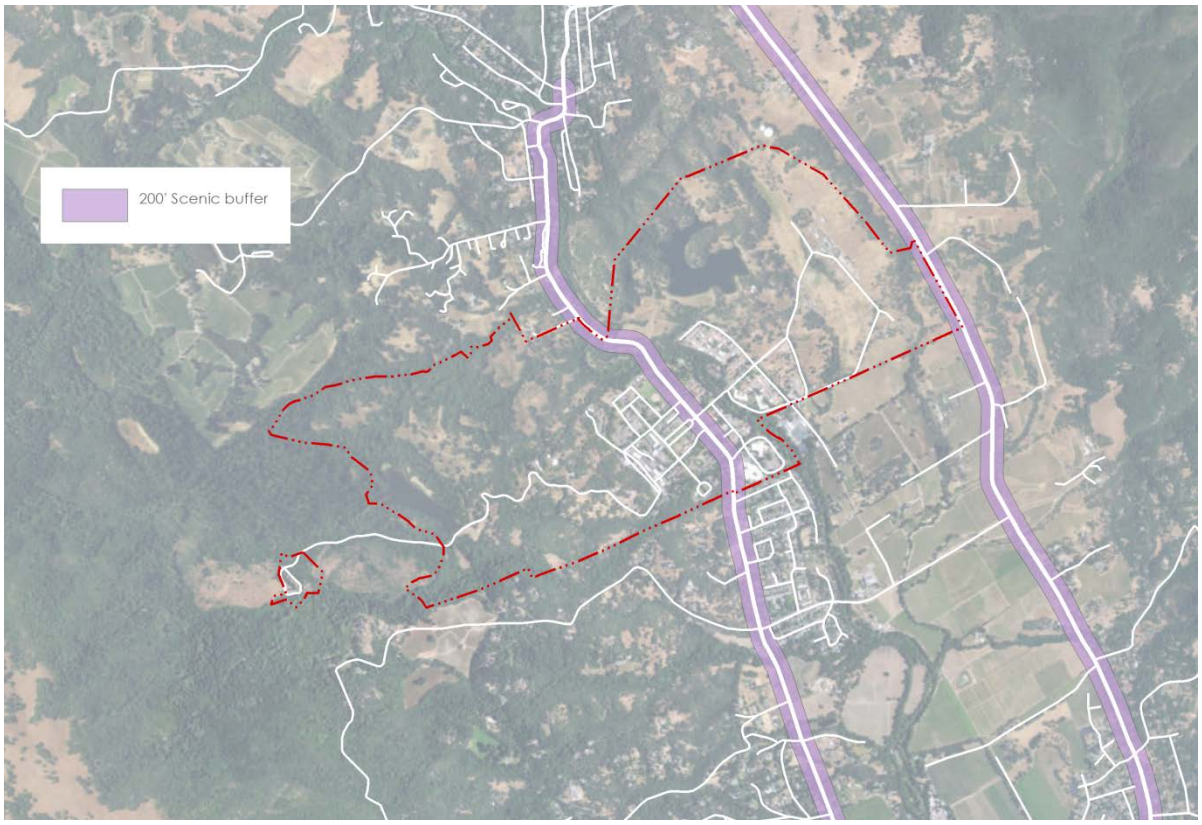
- The Land Use Element guides growth, development, and use of land through 2020. It specifically

designates SDC as a public/quasi-public resource because it “serves the community or public needs and are owned and operated by governmental agencies, non-profit entities, or public utilities”. According to Policy LU—20ff, the General Plan designates SDC as a “priority for future public uses if it is declared surplus and offered for sale to local agencies, particularly park, recreation, and open space uses and affordable housing.”

- The Open Space and Resource Conservation Element (OSRC Element) addresses open space for the preservation of natural resources, for the managed production of resources, for outdoor recreation, for public health and safety, and for archeological, historical, and cultural resources. The purpose of the OSRC Element is to preserve the natural and scenic resources in the County, and the Land Use Element is consistent policies included in the OSRC Element.

- The SDC property is surrounded by Scenic Landscape Units designated by the County; the Sonoma Mountains Unit, which includes Jack London SHP to the west, and the Sonoma Valley/Mayacamas Mountains Unit, which extends from the valley east of Highway 12 to the north and upslope. Numerous goals and policies pertain to the protection of the scenic character in these areas. Goal OCRC-2: Retain the largely open, scenic character of important Scenic Landscape Units, seeks to retain the rural, scenic character through limitation on development densities, protection of ridges and crests through limitations of ridgeline structures, and protection of hills and ridges from cuts and fills. The OSRC Elements also includes policies to limit amendments that increase residential densities and to avoid commercial or industrial uses in Scenic Landscape Units.

- Both Highway 12 through SDC and Arnold Drive are identified as Scenic Corridors in the General Plan. Goal OSRC-3 seeks to preserve roadside landscapes with high visual quality, and several objectives identify restrictions on future land uses and development including restrictive siting and setback policies to preserve visual quality and protect the rural character of the area. This zoning establishes a setback of 30 percent of the lot depth up to a maximum of 200 feet from the centerline of the road; within that area, development is prohibited with certain exceptions.



Arnold Drive and Highway 12 scenic buffers designated by the county.

- SDC is in the Sonoma Valley Habitat Connectivity Corridor, one of two Habitat Connectivity Corridors mapped in the Open Space and Resource Conservation Element of the Sonoma County General Plan 2020. This Corridor provides a one-mile-wide connection across Sonoma Valley from Sonoma Mountain to the wildlands of the Mayacamas Mountains.

- The SDC property supports vast biotic resources including riparian corridors, marshes and wetlands, sensitive natural communities, and habitat connectivity corridors, and the OSRC include goals and policies designed to protect these resources. Riparian corridors on the property fall within the biotic resources zone where setbacks apply to all future development to allow for the protection of riparian vegetation, water resources, and habitat values (SCGP Goal OSRC-8). The SDC parcels are zoned for a 50' setback from the top of the higher bank of creeks. Similarly, special-status species, marshes and wetlands, and sensitive natural communities are regulated to protect and enhance the County's natural habitats and diverse plant and animal communities (SCGP Goal OSRC-7). Of particular relevance is the preservation and protection of native trees and woodlands, including oak woodlands (SCGP Policies OSRC-7k and 7l) and control of invasive species, native plant regeneration, and control of Sudden Oak Death (SCGP Policy OSRC-7p). In addition to the protection of riparian corridors, wetlands, and wildlife, water resources are protected through water quality, ground water, and conservation and re-use, watershed management policies that will guide the future development of the SDC property (see SCGP Goals WR-1 to 6).

- The SDC property includes numerous known historic resources as well as archaeological and

cultural resources. The OSRC Element seeks to protect and preserve the County's heritage through implementation of goals and policies OSRC-19 which identifies the need to protect and preserve significant archaeological and historic sites in Sonoma County.

State and Federal Regulations

California Environmental Quality Act

The California Environmental Quality Act (CEQA) was passed in 1970 to institute a statewide policy of environmental protection. Projects undertaken, funded, or requiring a permit by a state or local public agency must comply with CEQA. The primary purposes of CEQA are to inform decision-makers and the public about the potential environmental impacts of the proposed activities, identify ways that environmental damage can be avoided or significantly reduced, require changes in projects through the use of alternatives or mitigation measures when feasible, and disclose to the public the reasons why a project was approved if significant environmental effects are determined.

The sale of surplus property by the State of California is commonly exempt from the provisions of CEQA under Section 15312, Surplus Government Property Sales. The exemption applies except for parcels of land located in an area of statewide, regional, or area-wide importance. The State would need to determine whether or not the sale is exempt. Regardless of the CEQA requirements for the property sale, any future development of the property would likely require CEQA compliance and the documentation needs would vary depending on the proposed project.

- The open space parcel transfer does not depend on the transfer or development of the other parcels; therefore, the transfer of the open space parcels could occur before transfer of the remainder of the property.
- Open space transfer could be exempt from CEQA:
    - CEQA exemption Section 15316, Transfer of Ownership of Land in Order to Create Parks. Class 16 consists of the acquisition, sale, or other transfer of land in order to establish a park where the land is in natural condition. CEQA will apply when a management plan is proposed that will change the area from its natural condition.
    - CEQA exemption Section 15325, Transfers of Ownership in Land to Preserve Existing Natural conditions and Historical Resources. Class 25 exemption allows for the acquisition, sale, or transfer of property.
    - If a management plan is developed for the open space parcels, then the management plan would be subject to CEQA. However, the transfer could be exempt.
- Transfer of the developed/redeveloped parcels would require compliance with CEQA. It does not meet the criteria for an exemption.

California Department of Fish and Wildlife/California Department of Fish and Game Code

The California Department of Fish and Wildlife (CDFW) is responsible for managing, conserving, and protecting the state's biological resources including fish, wildlife, and plants. Under the California Fish and Game Code, CDFW must be notified when work is proposed in a creek, river, or lake in which there is at any time an existing fish or wildlife resource or from which such resources derive benefit. Projects affecting or potentially affecting such resources must obtain a Streambed Alteration Agreement from CDFW and comply with CEQA. Future development of the property will require consultation with CDFW and issuance of a permit if work is proposed in any aquatic resources or where native species would derive benefit.

Under sections 3511 (birds), 4700 (mammals), 5050 (reptiles and amphibians), and 5515 (fish) of the California Fish and Game Code, CDFW designates certain animal species as "fully protected." Fully protected species may not be taken or possessed at any time. Future development of the property will require avoidance of fully protected species.

Regional Water Quality Control Board

Under Section 13263 of the Porter-Cologne Water Quality Act, the Regional Water Quality Control Board (RWQCB) is authorized to regulate discharge and fill within waters of the State, wetlands, including isolated features. Through this process the local RWCQB issues a Waste Discharge Requirement (WDR). Future development of the property will require consultation with the RWQCB and issuance of a permit if work is proposed in any wetland or other waters of the state, including isolated wetlands. Issuance of a WDR requires CEQA compliance.

State and Federal Endangered Species Act Compliance

Under the federal Endangered Species Act of 1973 (FESA), the Secretary of the Interior and the Secretary of Commerce have joint authority to list a species as threatened or endangered. Two federal agencies oversee the FESA: the U.S. Fish and Wildlife Service (USFWS), a part of the Department of the Interior, has jurisdiction over plants, wildlife, and resident fish, while NOAA's National Marine Fisheries Service (NOAA Fisheries Service), a part of the Commerce Department, has jurisdiction over anadromous fish and marine fish and mammals. Section 7 of the FESA mandates that all federal agencies consult with USFWS and NOAA Fisheries Service to ensure that federal agency actions do not jeopardize the continued existence of a listed species or destroy or adversely modify critical habitat for listed species.

The FESA prohibits "take" of any fish or wildlife species listed as threatened or endangered, including the destruction of habitat that could hinder species recovery. Section 10 of the FESA requires the issuance of an incidental take permit before any public or private action may be taken that would potentially result in "take," which is defined as actions that would potentially harm, harass, injure, kill, capture, collect, or otherwise hurt any individual of an endangered or threatened species. Future development of the property will require consultation with USFWS and/or NOAA Fisheries issuance of a permit if proposed activities will result in take or habitat modification for listed species.

Under the California Endangered Species Act of 1984 (CESA), CDFW is responsible for maintaining a list of endangered and threatened species. The list also includes federally proposed and state candidate species, which are species that CDFW has formally noticed as being under review for addition to either the list of endangered species or the list of threatened species, as well as fully protected species. CDFW also maintains lists of California special concern species that serve as watch lists. Pursuant to the requirements of CESA, an agency reviewing a proposed project within its jurisdiction must determine whether any state-listed as endangered or threatened species may be present in the project area and determine whether the proposed project will have a potentially significant impact on such species. In addition, CDFW encourages informal consultation on any proposed project that may affect candidate species.

Protected Bird Species

Nesting native bird species are protected under both federal and state regulations. According to the US Fish and Wildlife Service, under the federal Migratory Bird Treaty Act of 1918 (MBTA; 50 CFR 10.13), "it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg or any such bird, unless authorized under a permit issued by the Secretary of the Interior. Some regulatory exceptions apply. Take is defined as: 'pursue, hunt, shoot,

wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." Bald and golden eagles are also protected under the federal Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) of 1940.

Birds and their nests are also protected under the California Fish and Wildlife Code (§3503 and §3513). Under §3503, "it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto." Under §3513, "it is unlawful to take or possess any migratory nongame bird as designated in the Migratory Bird Treaty Act or any part of such migratory nongame bird except as provided by rules and regulations adopted by the Secretary of the Interior under provisions of the Migratory Treaty Act." The federal Endangered Species Act and California Endangered Species Act also protect nesting threatened and endangered bird species.

Activities in areas with suitable nesting habitat during the breeding period, typically mid-February to mid-August in this area, could result in nest abandonment or loss of native nesting birds unless appropriate actions are taken (e.g., preconstruction surveys, avoidance, monitoring, etc.; RHJV 2004).

California Register of Historical Resources

The California Register is "an authoritative listing and guide to be used by state and local agencies, private groups and citizens in identifying the existing historical resources of the state and to indicate which resources deserve to be protected, to the extent prudent and feasible, from substantial adverse change" (PRC Section 5024.1[a]). The criteria for eligibility to the California Register are based on National Register criteria (PRC Section 5024.1[b]). Certain resources are determined by the statute to be automatically included in the California Register, including California properties formally determined eligible for or listed in the National Register.

To be eligible for the California Register as a historical resource, a prehistoric or historic-period resource must be significant at the local or State level under one or more of the following criteria:

- Is associated with events that have made a significant contribution to the broad patterns of
- California's history and cultural heritage;
- Is associated with the lives of persons important in our past;
- Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or
- Has yielded, or may be likely to yield, information important in prehistory or history (CEQA Guidelines Section 15064.5 [a][3]).

For a resource to be eligible for the California Register, it must also retain enough integrity to be recognizable as a historical resource and to convey its significance. The seven aspects of integrity are: location, design, setting, materials, workmanship, feeling and association. A resource that does not retain sufficient integrity to meet the National Register criteria may still be eligible for listing in the California Register. A resource that has lost its historic character or appearance may still have sufficient integrity for the California Register if it maintains the potential to yield significant scientific or historical information or specific data. The Main Building (the brick building at the west end of the main drive) was made a National Historical Landmark in August 2000. SDC may be nominated as a historic district, and many buildings on the property may be contributors to the district or may be historic resources themselves.

California Public Resources Code

Several sections of the PRC protect cultural resources and PRC Section 5097.5 protects vertebrate

paleontological sites located on public land. Under Section 5097.5, no person shall knowingly and willfully excavate upon, or remove, destroy, injure, or deface, any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site (including fossilized footprints), inscriptions made by human agency, rock art, or any other archaeological, paleontological, or historical feature situated on public lands, except with the express permission of the public agency that has jurisdiction over the lands. Violation of this section is a misdemeanor.

PRC Section 5097.98 states that if Native American human remains are identified within a project area, the landowner must work with the Native American Most Likely Descendant as identified by the NAHC to develop a plan for the treatment or disposition of the human remains and any items associated with Native American burials with appropriate dignity. California Health and Safety Code Section 7050.5 prohibits disinterring, disturbing, or removing human remains from a location other than a dedicated cemetery. Section 30244 of the PRC requires reasonable mitigation for impacts on paleontological and archaeological resources that occur as a result of development on public lands.

Jurisdictional Wetlands and Waters

Jurisdictional wetlands and other waters of the U.S., including stream channels, are regulated by the U.S. Army Corps of Engineers (Corps) under the provisions of Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Any disposal of dredged or fill material and structures, as well as work in wetlands or waters, require a permit from the Corps. Future development of the property will require consultation with the Corps and issuance of a permit if work is proposed in any wetland or other waters of the U.S.

Under Section 401 of the federal Clean Water Act, the Corps is required to meet state water quality regulations prior to granting a Section 404 permit. This is accomplished by application to the local RWQCB for Section 401 certification that requirements have been met. Future development of the property will require consultation with the RWQCB and issuance of a permit if work is proposed in any wetland or other waters of the U.S. A Section 401 Water Quality Certification will require CEQA compliance.

8 Considerations for Reuse and Conservation

This section identifies potential strategies for protecting natural resources in future redevelopment, as well as opportunities for improving ecological conditions. Implementing some of these strategies would require funding or other resources, and/or could limit fund-generating activities on the site. In other cases, the strategies may be cost-neutral and/or could increase fund-generating opportunities. Weighing economic considerations, natural resource values and other landowner and stakeholder interests is expected to be part of the next phase of planning for the site.

The strategies are grouped by resource type: wildlife corridor; riparian and aquatic habitat; other sensitive ecological resources; and recreational resources. See Exhibit 6 for a map of key sensitive natural resources, and Exhibit 7a-d for locations of key opportunities for enhancement. Also see Future Studies section below.

Wildlife Corridor

Strategies for Protection

All Settings

- Avoid conversion of native land cover to developed or agricultural uses.
- Limit new road, driveway, and trail construction, especially outside the core campus area. If new roads are constructed or old roads upgraded, consider crossing structures to accommodate wildlife.
- Maintain crossing structures. Culverts should be checked periodically for debris, vegetation overgrowth (e.g., Himalayan blackberry), and other blockages.
- Limit fencing and use wildlife-friendly fence designs (see SLT 2014a and Hanopy 2009). Fencing that crosses or bisects streams—or otherwise discourages use of safe passages--is particularly problematic.
- Meet but do not exceed fire safe vegetation maintenance guidelines. Leave wildlife habitat beyond the defensible space zone intact.
- Do not use pesticides.
- Engage in ongoing monitoring and/or collaborate with partners to evaluate changes to natural resources and wildlife use with changing land use.
- Educate and outreach to property owners and managers about actions they can take to protect the wildlife corridor. Consider partnering with agencies like the Sonoma Resource Conservation District and Natural Resources Conservation Service for outreach, technical and financial assistance.

Residential and Commercial Settings

- Keep speed limits and traffic speeds low (25 miles per hour maximum).
- Minimize human presence at night.
- Minimize outdoor night lighting, especially near creeks or other known high wildlife use areas. Keep lighting to

Chain link fence at Suttonfield Lake, a barrier to some wildlife.

Multiple trails providing similar routes.

the minimum needed for safety, only within 50' of buildings, as low as possible, pointed toward the structure or immediate ground, and use the lowest wattage possible. Use narrow spectrum bulbs to reduce the range of species affected by lighting.

- Do not allow pets to roam freely in wildlands.
- Educate residents about living safely with mountain lions.

Agricultural Settings

- Create native plant hedgerows in or along cultivated fields, as Oak Hill Farm has done in some of its fields. This provides cover for small and medium size wildlife.
- Engage with livestock operators to address any concerns of predation by native wildlife, and seek solutions compatible with resource protection.
- Avoid nighttime agricultural work (often done in vineyards; not compatible with corridor).

Opportunities for Enhancement

- Decommission unneeded roads, driveways, buildings, trails, and fencing. If the site is consolidated with adjacent parklands, there are many opportunities to reduce fencing and decommission duplicate trails. Look for opportunities to consolidate/reduce campus footprint.
- Widen corridors of native habitat along creeks (see below for discussion of recommended setbacks).

Concrete rubble in drainage.

- Improve undercrossing conditions; see Wildlife Crossings section above.
- Look for opportunities to improve wildlife permeability along the site's south-central border.
- Incorporate native plants into new landscaping and when replacing declining ornamentals.
- Consider wildlife needs and behavior when planning lighting along roads; avoid lighting near undercrossings, but lighting may be appropriate in any areas where roadkill is frequent.
- In bridge/undercrossing design, include some upland above the scour zone of streams for winter crossing

Riparian Habitat, Steelhead, and other Aquatic Species

Strategies for Protection

- Maintain existing buffers of riparian vegetation, which provides shade, shelter, habitat complexity, nutrient input, and/or a buffer from human presence.
- Maintain adequate flows and high water quality.
- Undertake an assessment of flow-related habitat conditions in Sonoma Creek and Hill Creek to

determine whether current diversions and withdrawal regimes may constrain fish populations.

Opportunities for Enhancement

- Expand buffers from developed areas, restoring native riparian vegetation.
- Manage invasive plants, restore native vegetation and improve structural habitat diversity on lower portions of Asbury and Hill Creeks.
- Remove arundo and other invasive plants on Sonoma Creek.
- Look for opportunities to reduce fish passage barriers; see Fish Passage Barriers section above.
- On upper Hill Creek, manage ropes course to prevent compaction and erosion.
- On lower Hill Creek, widen riparian corridor; consider laying back banks to provide floodplain access. Look for opportunities to decommission buildings adjacent to creek.
- Consider elimination/reduction of Roulette Springs diversion to enhance wetland habitat.
- Consider setting minimum bypass flow rates and limitations on the period of diversion for all diversion points, similar in nature to the Asbury Creek diversion, based on ecological instream flow needs.
- Remove concrete rubble from culverts on east side. Ensure no dumping of materials occurs near riparian areas.
- Prohibit dog use of reservoirs and enforce County ordinance requiring owners to pick up dog waste.
- Complete focused surveys for foothill yellow-legged frog on Hill and Asbury Creeks; further evaluate habitat conditions and enhancement needs.
- Coordinate with other organizations to identify sites with promise for restoring hydrologic function and providing benefits such as reduced flooding, increased groundwater recharge and retention, water quality improvement, and habitat improvement.

Other Sensitive Resources

Strategies for Protection

- Maintain areas of intact habitat; reduce developed footprint and restore native vegetation where possible.
- Maintain habitat connections with adjacent areas of high quality habitat (including those in Jack London SHP, Sonoma Valley Regional Park, and private lands).
- Perform spring surveys for special-status plants.
- Complete focused surveys for American badger, Northern spotted owl, foothill yellow-legged frog, California giant salamander and California red-legged frog on SDC; further evaluate habitat conditions and enhancement needs.
- Evaluate all buildings and structures on SDC for the presence of bats; further evaluate habitat conditions and enhancement needs. If bats are present, develop protection strategies for use during building repair or removal.
- Develop an invasive animal control program for American bullfrog on SDC; participate in local management programs to control widespread species (e.g., barred owl, wild turkey) if such programs become established.
- Monitor and control for the presence of feral cats.
- Avoid ground-disturbing activity outside the existing development footprint to prevent the spread of invasive species. Ensure that any agricultural operations do not facilitate the spread of invasive species.
- Avoid soil compaction and grading outside existing footprint to protect trees and other native

vegetation, natural regeneration.

- As appropriate to the habitat type, perform focused surveys for special-status species prior to grading, vegetation removal, or other development (including recreational/trail facilities) outside existing footprint. Perform pre-construction surveys and crew trainings as applicable.

Enhancement Opportunities

- Large wet meadow: Manage invasives (teasel, hemlock, Harding grass, other non-native perennial grasses); improve native diversity through plantings. If livestock grazing is to continue, develop a grazing plan that targets natural resource enhancement and protects oak regeneration. Consider planting woody species including valley oak, willows, and shrubs.
- East side grassland: Consider oak woodland/savanna restoration through plantings or protection of natural regeneration. If livestock grazing is to continue, develop a grazing plan that targets natural resource enhancement and protects oak regeneration.
- Grasslands throughout: Reduce yellow starthistle infestations. Consider use of fire or grazing to control invasives and encourage natives.
- Dump site along Orchard: Investigate possibility of removing garbage and restoring; note steep slope.
- Develop a fire management plan in cooperation with local fire agencies and fire ecologists that identifies site-specific goals and strategies for protection of both public safety and natural resources, some of which benefit from burning. Consider the use of controlled burning in areas of high fuels.
- Consider restoration plantings in forest or woodland settings found to be lacking in natural regeneration.

Recreational Resources

The recreational resources of the site—especially the trails and dirt roads—have been used and enjoyed by the community for decades and are strongly connected to adjacent public lands. There are many opportunities to maintain and improve recreational access to the site, while also protecting sensitive natural resources.

Constraints

- Prioritize protection of natural resources and wildlife use when considering recreational uses. Higher human and dog presence can result in decreased use by some wildlife species. (See California Water Resources Control Board's "Erase the Waste" campaign.) Recreational use levels are likely to increase dramatically if areas become a formal park/open space preserve with increased public visibility, and also if the proposed Sonoma Valley Regional Trail is developed along SDC's eastern edge.
- Substantial resources will be needed to manage new parklands in a way that protects the site's multiple sensitive resources. The more recreational opportunities offered, the more resources (staff, funding) likely needed to manage those.
- Some existing facilities are in varying levels of disrepair (e.g., Camp Via, soccer field) and would require either complete replacement or renovation before being fully functional.
- Trails are steep and eroding in some locations; access roads now used as trails were not necessarily designed with recreational use in mind.
- The site's bisection by Arnold Drive separates the two open space areas to some extent.
- There is limited ADA accessibility to trails.
- Allowable public uses on SDC trails should take into consideration the policies of adjacent parklands, and support their successful implementation. For instance, dogs are only allowed in one designated area and one designated trail in Jack London SHP to protect wildlife, but dogs are allowed in Sonoma Valley Regional Park. Off-leash dogs are not allowed in either park.

Duplicate trails along SDC northeastern boundary.

Opportunities for Enhancement

- Prioritize wildlife corridor protection when considering recreational uses.
- Open trails officially to public access.
- Consider integration of undeveloped lands and recreational facilities into existing adjacent park facilities (Jack London State Historic Park and Sonoma Valley Regional Park) for efficient, coordinated land management and recreational opportunities.
- Consider site needs, sensitivities and resources in relation to the mission, goals, and resources available to potential future owners or management agencies.

- Complete a detailed trail and road assessment and trail plan. Identify locations of erosion concern, trails to decommission or realign, drainage improvements needed, and ongoing maintenance needs.
- Link east and west sides with clear signage and a safe pedestrian route.
- Clarify access points, limitations, and regulations with signage; identify primary entry points; provide site maps. Consider possible trailhead parking on North Street at the base of Orchard Road. Consider preferred west side access to Suttonfield, which could be via Sonoma Valley Regional Park, pedestrian linkages to the west side of the campus, and/or through designated parking areas on the east side.
- Clarify linkages to adjacent public lands. Consolidate trails, decommission unneeded ones and informal ones. Direct recreational use to areas of lower ecological sensitivity.
- Coordinate management with that of adjacent parks and preserves for more effective and efficient efforts (e.g., invasive control, trail maintenance, restoration, possible prescribed burns).
- Provide opportunities for environmental and agricultural education.
- On core campus, inventory landscape trees and provide education on selected specimens and historic landscape setting (e.g. species labels, signage, or self-guided walks).
- Support regional trails through SDC where natural resources can be protected.

A variety of trail signage is present; much is in need of repair.

- Consider providing an ADA-accessible pedestrian overlook of Sonoma Creek, to allow for public education/enjoyment/awareness without negative impacts to creek
- Consider Camp Via rehabilitation, and possible use as children's camp or environmental education center; but note important location in corridor/mountain lion territory and ensure that uses are compatible.
- Improve ADA accessibility.
- Develop ropes course management guidelines to ensure course activities are compatible with resource protection. Include the course in the property wide erosion assessment, and conduct ongoing annual assessments of erosion and tree health. Minimize impacts to sensitive riparian and redwood habitat by implementing a limit to visitor numbers and limiting vehicular access.
- For ropes course users, consider offering overnight camping prior to courses on the old employee picnic grounds, or use of campus buildings for pre-course meeting space.
- Consider providing site access for limited hiking/walking/running events as long as those events protect natural resources.
- Consider community interest in swimming or fishing in Suttonfield Lake, balanced with concern for compatibility with wildlife use and water quality.
- Consider restoring soccer field maintenance and supporting community use. Consider addition

of restrooms and picnic area, and restoration of shed for shaded seating, snack bar, storage, or other recreational uses.

Recommended Setbacks

As described in the strategies and opportunities above, ensuring that developed areas are set back from sensitive natural areas—with natural vegetation between them--will help minimize the impacts of land uses on sensitive plants, wildlife, and aquatic resources. In general, the larger the setback, the greater the protection of natural resources (Castelle et al. 1994, Lee et al. 2004, Osborne and Kovacic 2004). Exact distances required for resource protection will vary with the nature of the proposed development, local qualities of the natural features, and qualities of the buffer zone vegetation. The distances below are a general guideline to setbacks that will help protect key ecological functions; they are based on PCI's ongoing literature review of this topic and field observations.

In some cases, current development (primarily buildings and paved areas) encroaches closer than these setbacks recommend. See Exhibit 9, which shows building footprints and other impervious surfaces with respect to potential riparian buffer areas. As building conditions are reviewed and future uses are explored, these areas of encroachment represent key locations to consider for opportunities to reduce building footprints or impervious areas. In determining appropriate setback distances, user behavior should also be considered. For instance, in a park setting, visitors will want to visit and explore special habitats regardless of formal trail placement, and requiring very wide setbacks for trails from destination habitats could lead to informal trail creation. Informal trail creation could in turn have greater impacts on native habitats than carefully-planned formal trails.

Table 8. Recommended Setbacks from Sensitive Habitats

Habitat Type	Impact Type	Recommended Setback[8]	Rationale
Creeks, Lakes and Wetlands[9]	Low-Medium (e.g., trails, benches)	Sonoma Creek: 50'[10] Other Settings: 25'	- Allows space for natural creek/wetland adjustment. - Reduces erosion into creek/wetland. - Allows for natural regeneration of native vegetation and maintenance of creek shading. - Helps maintain migration corridors for wildlife by reducing human presence.
	High (e.g., buildings, parking)	Sonoma Creek: 100'-300' Other Settings: 50-100' *Upper range of setbacks recommended where feasible or where already in place.*	- Increases water quality protection (sediment and nutrient removal). - Allows for greater natural regeneration of trees and greater vegetative diversity. - Protects against potential changes to temperature and hydrology. - Improved connectivity between aquatic and upland habitats and more effective wildlife corridors.
Valley Oak Woodland and Redwood Forest	Low-Medium	25-50' *Upper range of setbacks recommended where feasible or where already in place.*	- Reduces grading damage or compaction of tree root zone. - Improves infiltration of water and air into soil for tree roots. - Protects understory species and seedlings from trampling.
	High	No high impact activities anticipated or recommended near redwoods. For oaks, avoid grading within 1.5 times the diameter of the dripline.	- As above; greater setbacks required to protect roots from more extensive grading and compaction.
Other Sensitive Native Habitat[11]	Low-Medium	25'	- Reduces likelihood of trampling and infestation by invasive species. - Allows for natural regeneration.
	High	50'	- Protects against potential changes to hydrology, sun/shade exposure.

[8] Setbacks from riparian settings are from top of bank. See Exhibit 9. Top of bank is located at the edge of the active channel or, where present, the active floodplain.
[9] Sonoma County setback for development along Sonoma Creek is 50'.
[10] Setback applies to limited creek access points. More extensive linear impacts (e.g., trails that closely parallel the creek) not recommended. Trails that extend across important wildlife pathways are also not recommended.
[11] For example, stands of native grassland that may be identified as more detailed site planning proceeds.

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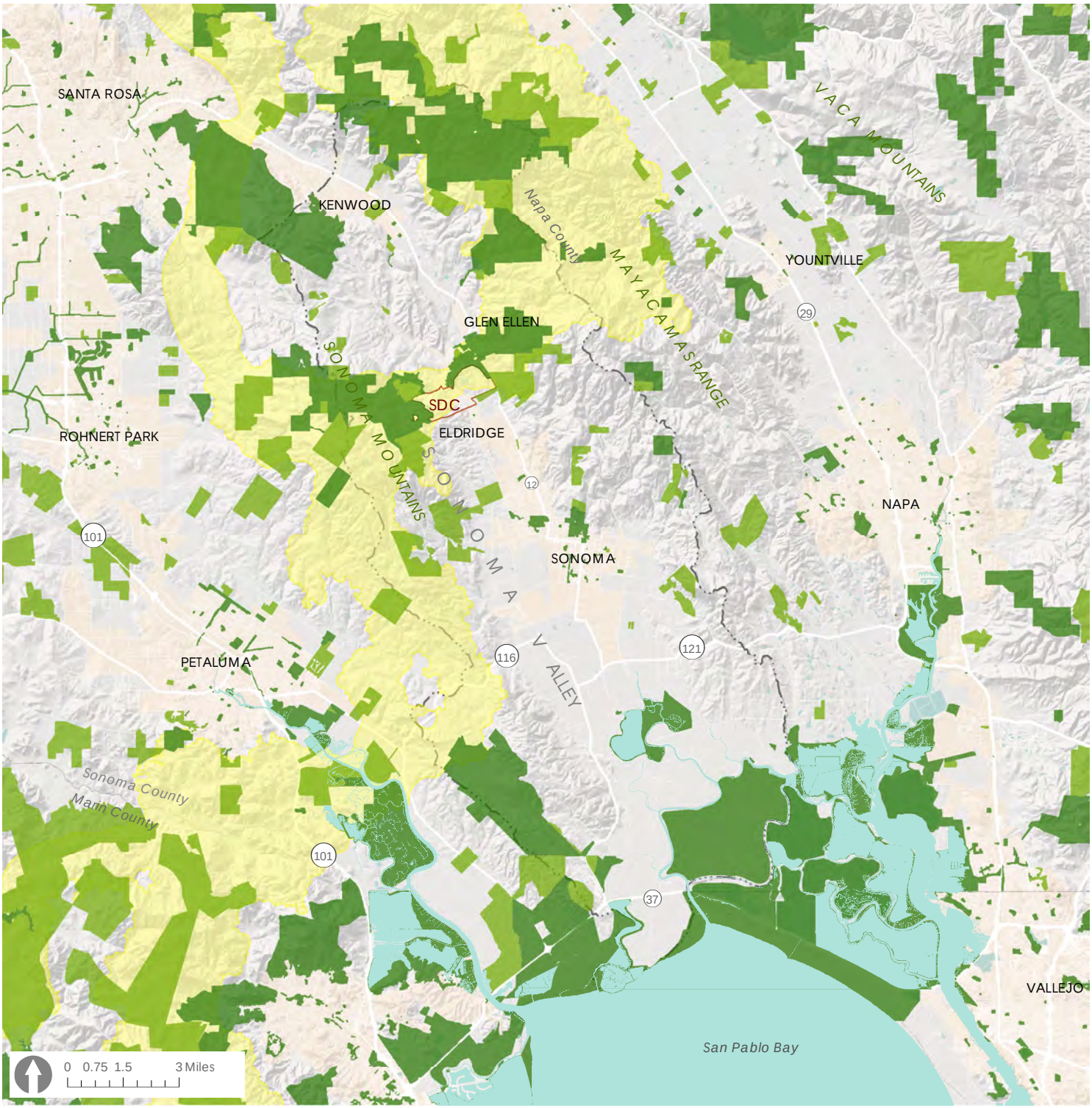
Exhibits

Exhibit 1a

PROTECTED LANDS AND CRITICAL WILDLIFE LINKAGES IN THE REGION



SDC Property

Protected Lands, Public or Private Ownership

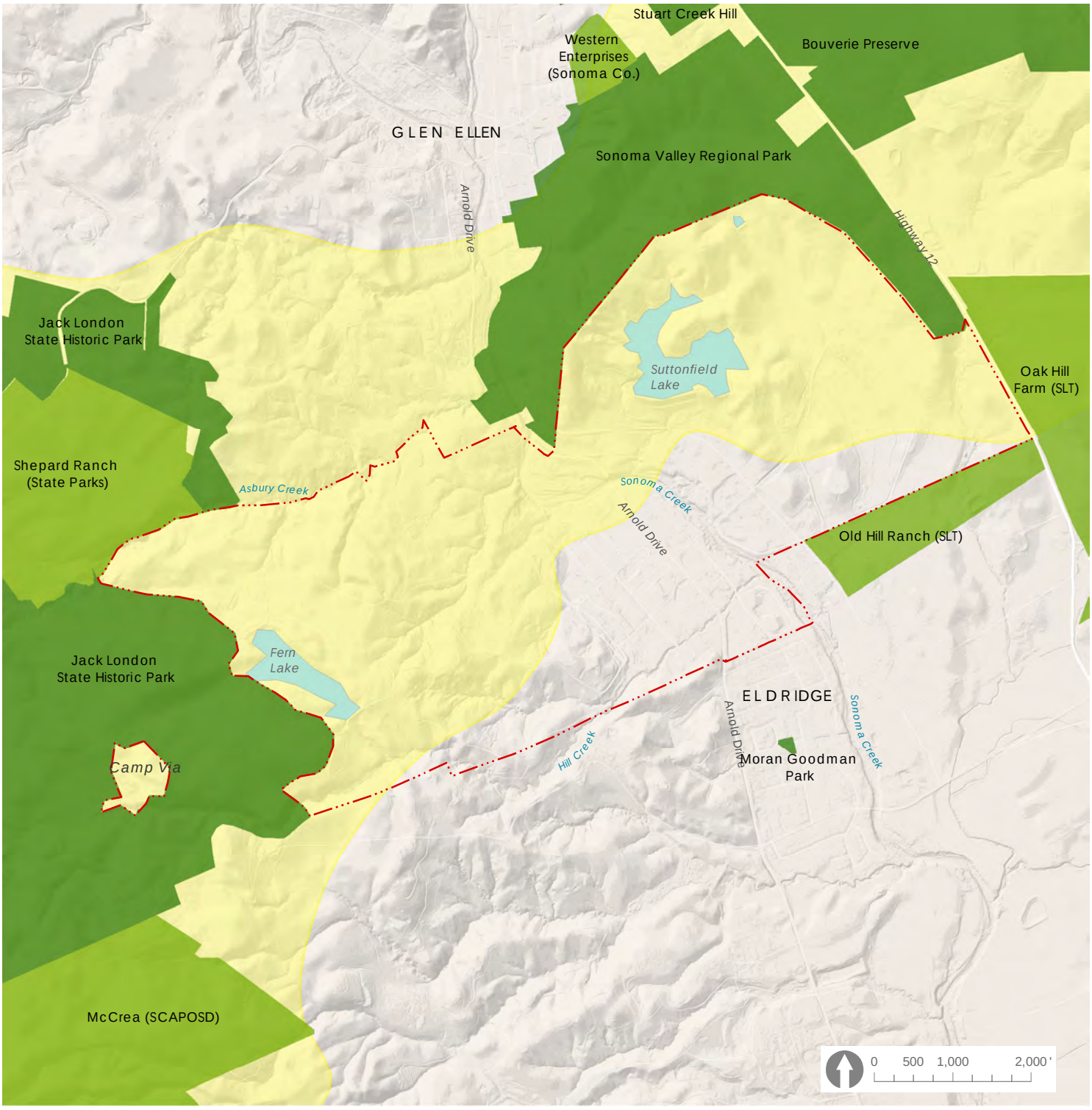
Other Lands Protected by Conservation Easement

Critical Wildlife Linkage, Marin Coast-Blue Ridge

Sources
USGS, US Census Bureau, California Geoportal, GreenInfo Network, Sonoma Ecology Center, Conservation Lands Network

Exhibit 1b

PROTECTED LANDS AND CRITICAL WILDLIFE LINKAGES - SDC VICINITY



SDC Property

Protected Lands, Public or Private Ownership

Other Lands Protected by Conservation Easement

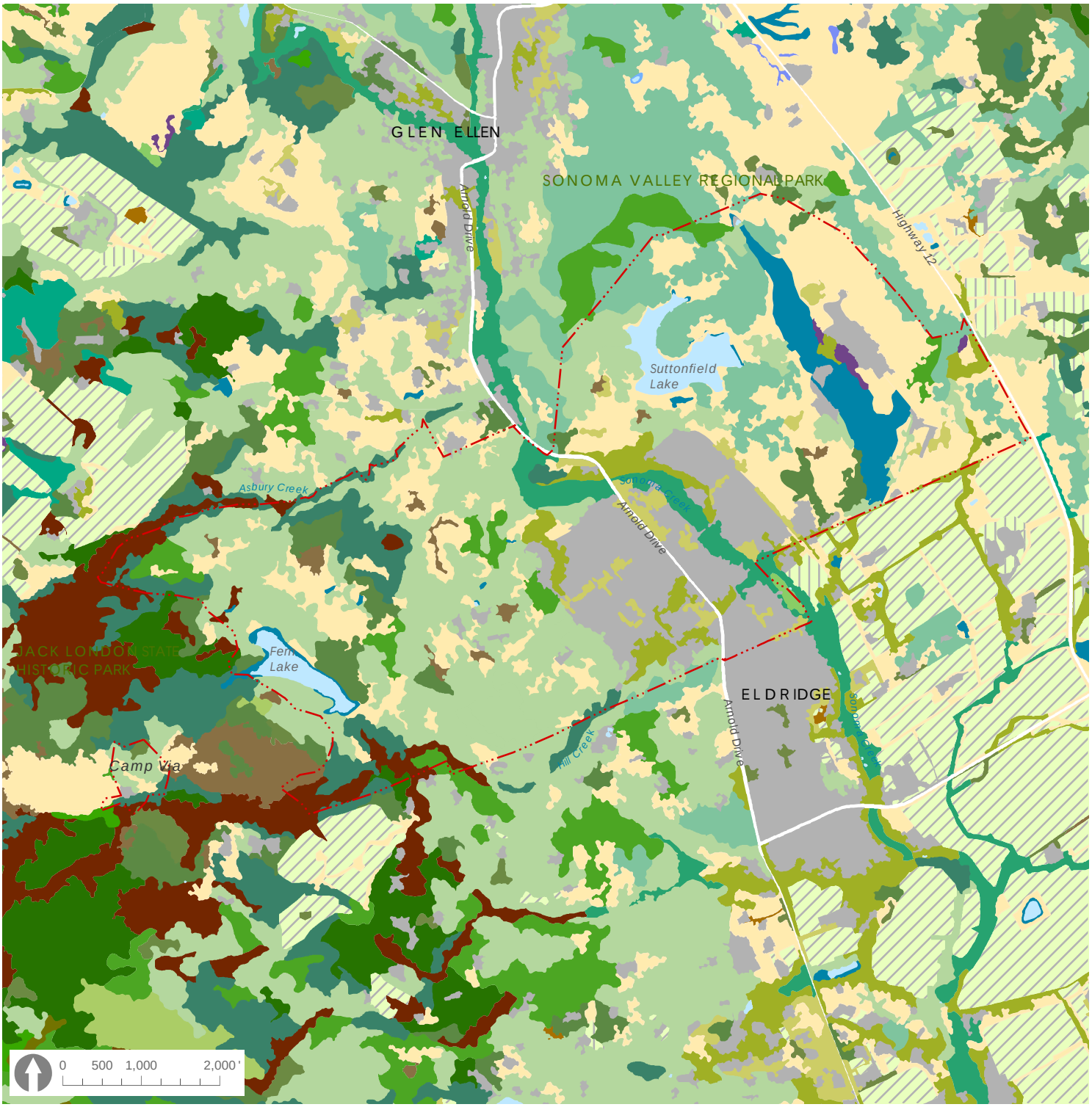
Critical Wildlife Linkage, Marin Coast-Blue Ridge

Sources
USGS, California Geoportal, GreenInfo Network, Conservation Lands Network, California Protected Areas Database

SCAPOSD: Sonoma County Agricultural Preservation and Open Space District
SLT: Sonoma Land Trust

Exhibit 2a

VEGETATION



SDC Property

FOREST & WOODLAND

- Bay Forest
- Bigleaf Maple Forest
- Black Oak Woodland
- Blue Oak Woodland
- Canyon Live Oak Woodland
- Coast Live Oak Woodland
- Coast Redwood Forest
- Cottonwood Forest
- Douglas-fir Forest
- Eucalyptus Stand
- Madrone Forest
- Mixed Oak Woodland
- Non-native Forest
- Oregon Oak Woodland
- Valley Oak Woodland
- Vancouverian Riparian Deciduous Forest

SHRUBLAND

- Chaparral
- Coyote Brush Scrub
- Himalayan Blackberry Brambles
- Non-native Shrub

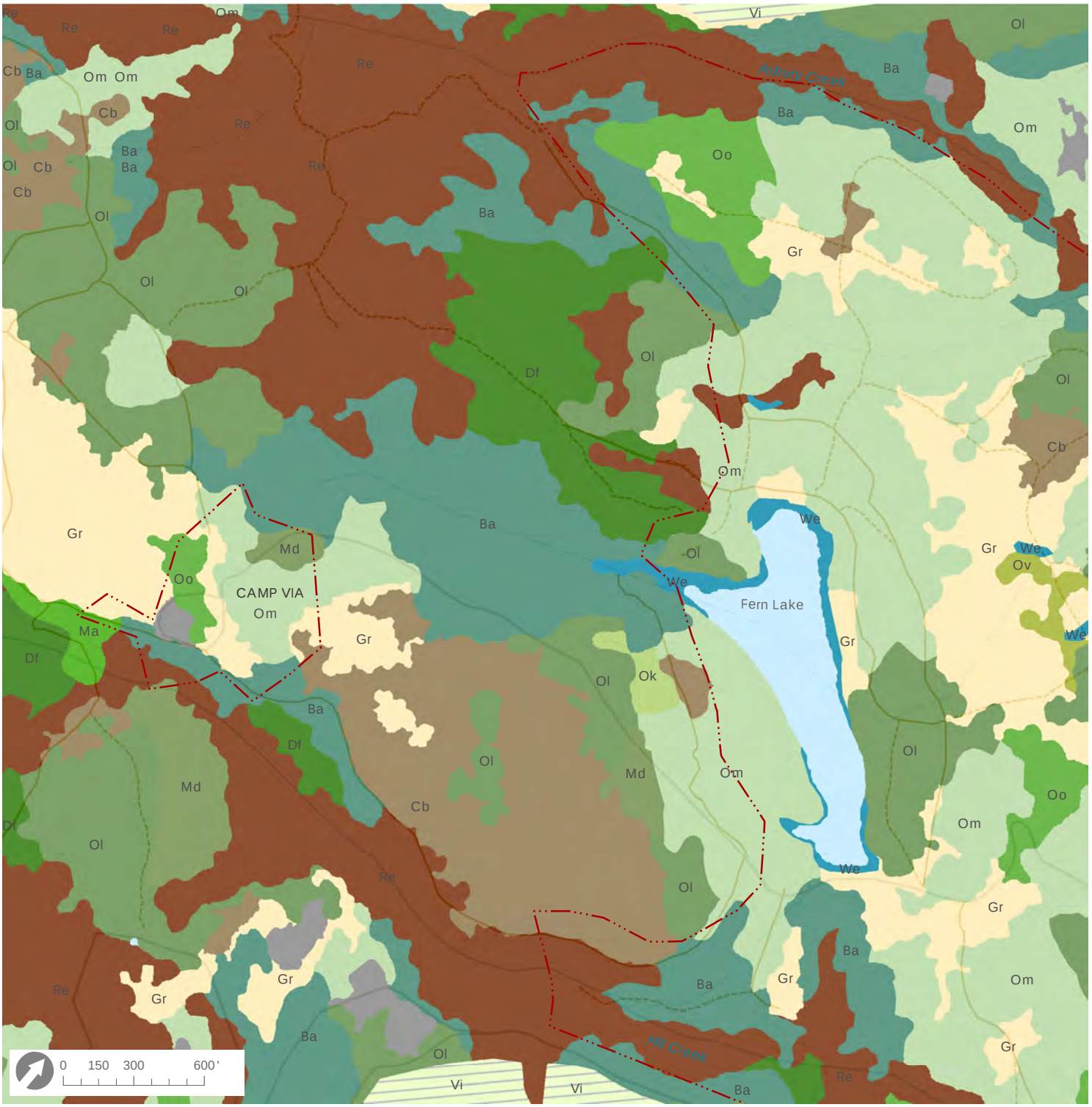
HERBACEOUS AND OTHER

- Grassland
- Vernal Pool
- Freshwater Aquatic
- Wetland
- Vineyard
- Other Agriculture
- Developed
- Water

Sources
Sonoma Veg Map, PCI

Exhibit 2b

VEGETATION - SDC WEST

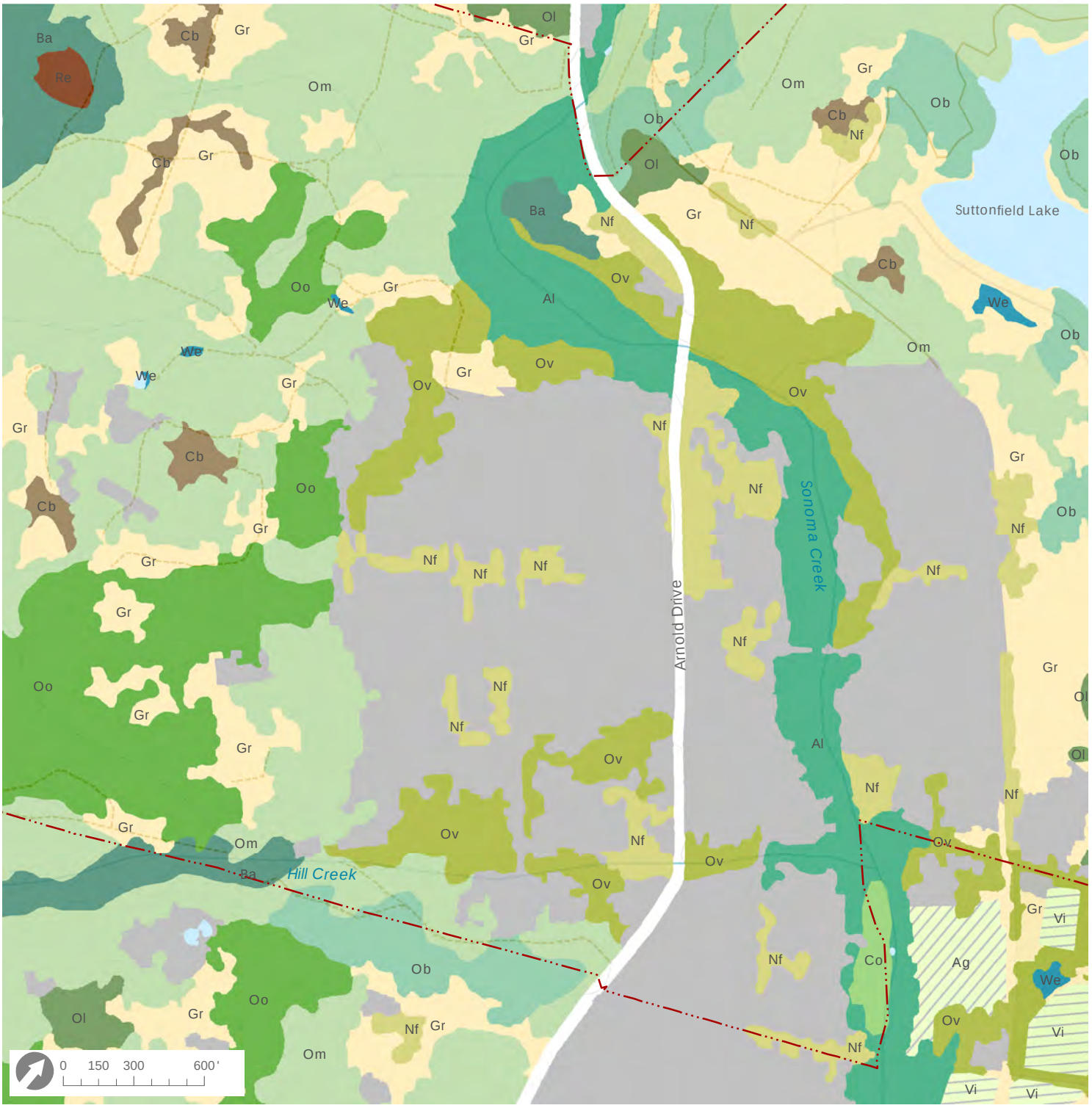


- SDC Property
- Unpaved access road
- Trail
- 5' Contours
- Bay Forest (Ba)
- Bigleaf Maple Forest (Ma)
- Black Oak Woodland (Ok)
- Coast Live Oak Woodland (Ol)
- Coast Redwood Forest (Re)
- Douglas-fir Forest (Df)
- Madrone Forest (Md)
- Mixed Oak Woodland (Om)
- Oregon Oak Woodland (Oo)
- Valley Oak Woodland (Ov)
- Coyote Brush Scrub (Cb)
- Grassland (Gr)
- Wetland (We)
- Water
- Vineyard (Vi)
- Developed

Sources
USGS, Sonoma Veg Map, PCI

Exhibit 2c

VEGETATION - SDC CENTRAL

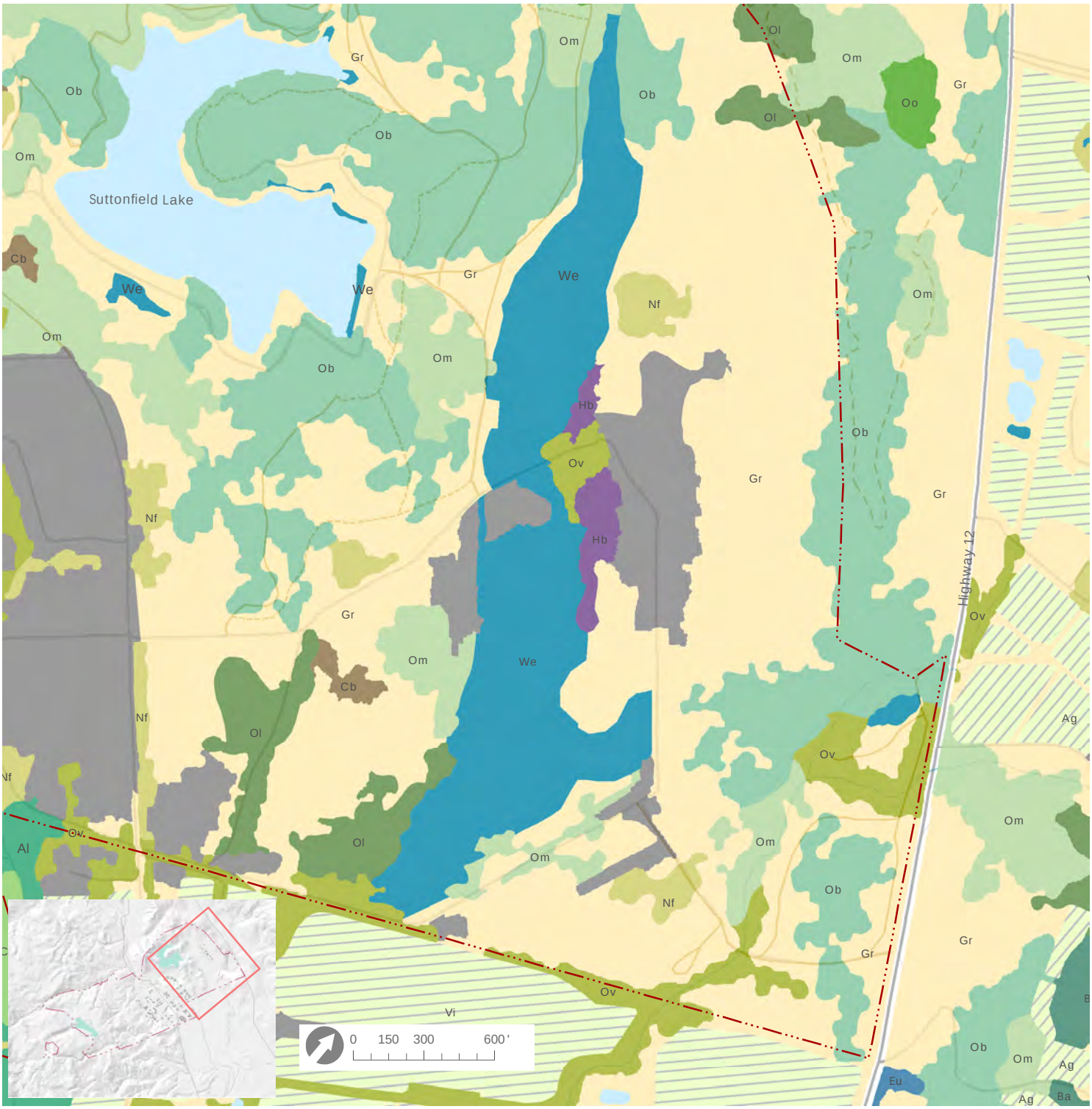


- SDC Property
- Paved road
- Unpaved access road
- Trail
- 5' Contours
- Bay Forest (Ba)
- Blue Oak Woodland (Ob)
- Coast Live Oak Woodland (Ol)
- Coast Redwood Forest (Re)
- Cottonwood Forest (Co)
- Mixed Oak Woodland (Om)
- Non-native Forest (Nf)
- Oregon Oak Woodland (Oo)
- Valley Oak Woodland (Ov)
- Alder Riparian Forest (Al)
- Coyote Brush Scrub (Cb)
- Grassland (Gr)
- Wetland (We)
- Water
- Vineyard (Vi)
- Nursery or Ornamental Horticultural Area
- Developed

Sources
USGS, Sonoma Veg Map, PCI

Exhibit 2d

VEGETATION - SDC EAST



SDC Property

5' Contours

Bay Forest (Ba)

Bigleaf Maple Forest (Ma)

Black Oak Woodland (Ok)

Blue Oak Woodland (Ob)

Canyon Live Oak Woodland (Oc)

Coast Live Oak Woodland (Ol)

Coast Redwood Forest (Re)

Cottonwood Forest (Co)

Douglas-fir Forest (Df)

Eucalyptus Stand (Eu)

Madrone Forest (Md)

Mixed Oak Woodland (Om)

Non-native Forest (Nf)

Oregon Oak Woodland (Oo)

Valley Oak Woodland (Ov)

Alder Riparian Forest (Al)

Chaparral (Ch)

Coyote Brush Scrub (Cb)

Himalayan Blackberry Brambles (Hb)

Non-native Shrub (Ns)

Grassland (Gr)

Vernal Pool (Vp)

Freshwater Aquatic (Aq)

Wetland (We)

Water

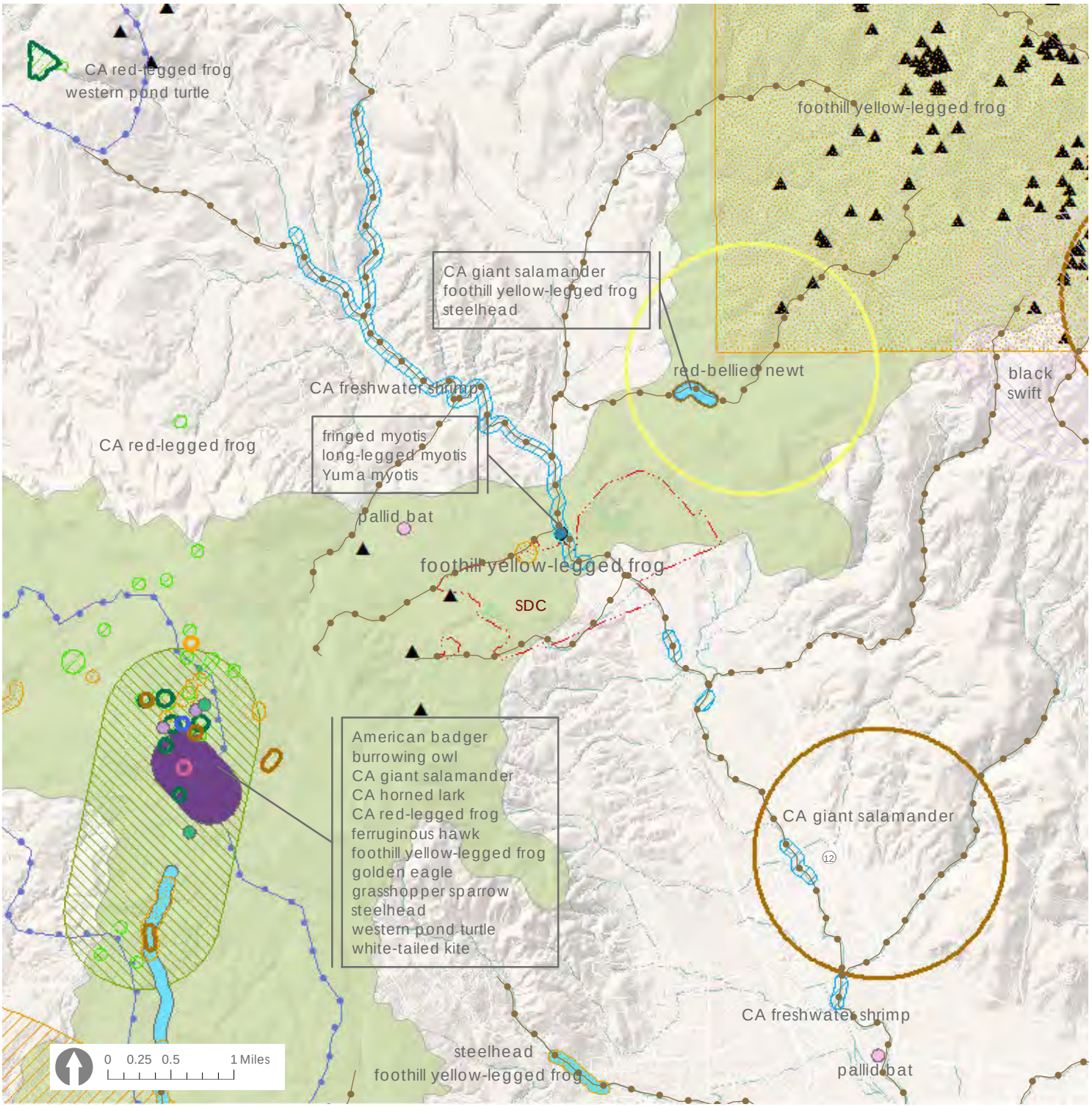
Vineyard (Vi)

Other Agriculture (Ag)

Developed

Exhibit 3

SPECIAL-STATUS WILDLIFE OCCURRENCES & SONOMA VALLEY WILDLIFE CORRIDOR



- SDC Property
- Critical Wildlife Linkage, Marin Coast-Blue Ridge
- Central CA coast steelhead Critical Habitat
- California red-legged frog Critical Habitat
- northern spotted owl
- American badger
- black swift
- burrowing owl
- CA freshwater shrimp
- CA giant salamander
- CA horned lark
- CA red-legged frog
- CA tiger salamander
- ferruginous hawk
- foothill yellow-legged frog
- fringed myotis
- golden eagle
- grasshopper sparrow
- long-legged myotis
- pallid bat
- red-bellied newt
- steelhead - central CA coast DPS
- western pond turtle
- white-tailed kite
- Yuma myotis

Sources: CNDDB (CDFW), PCI, USGS

NOTES: Map does note include records for non-listed invertebrates and species known to be extinct. See text. Species occurrence polygons represent approximate locations as provided by the California Natural Diversity Database (CDFW 2018); populations do not necessarily occupy all of each polygon.

Exhibit 4

SPECIAL-STATUS PLANT AND SENSITIVE HABITAT OCCURRENCES

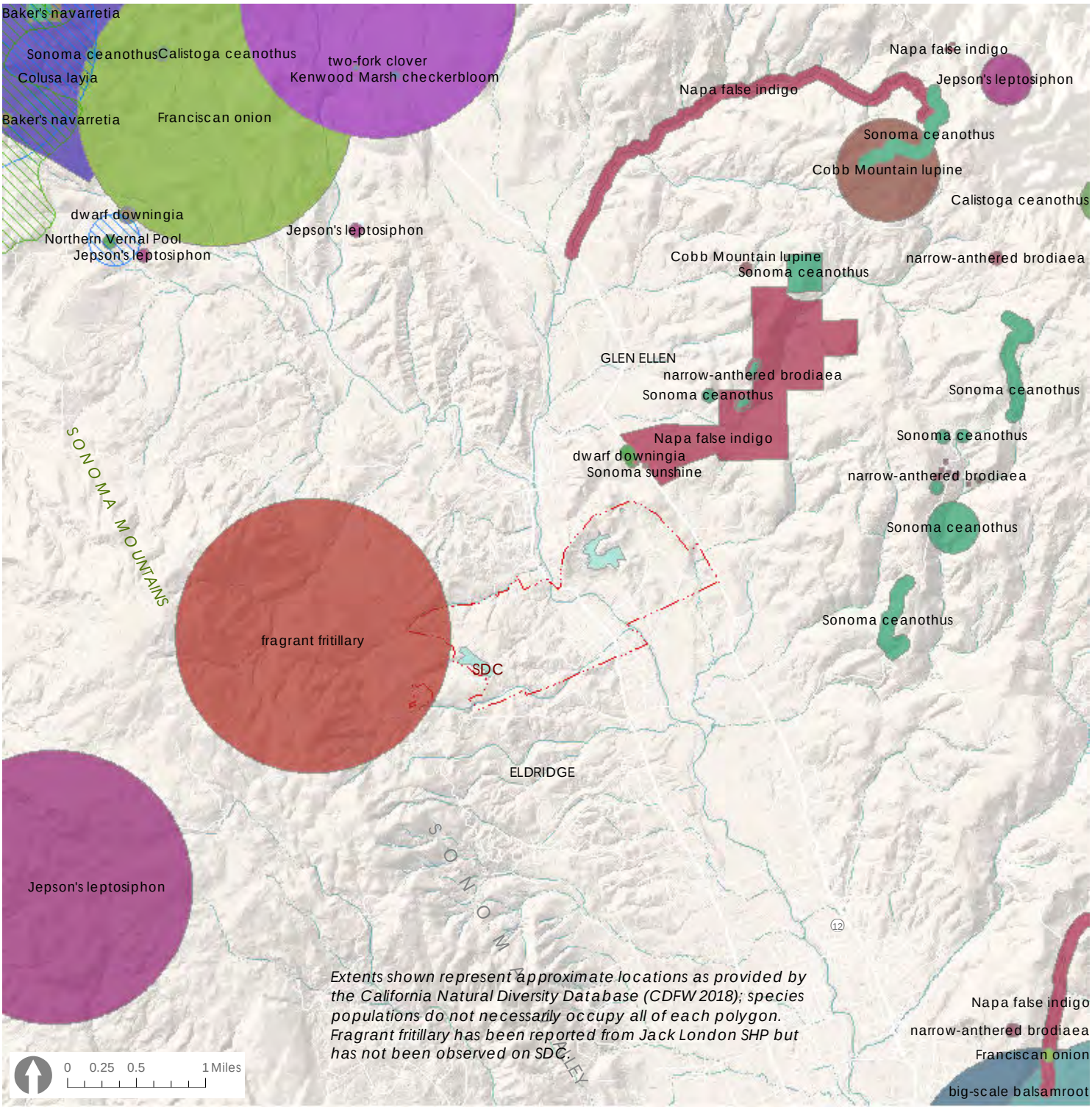
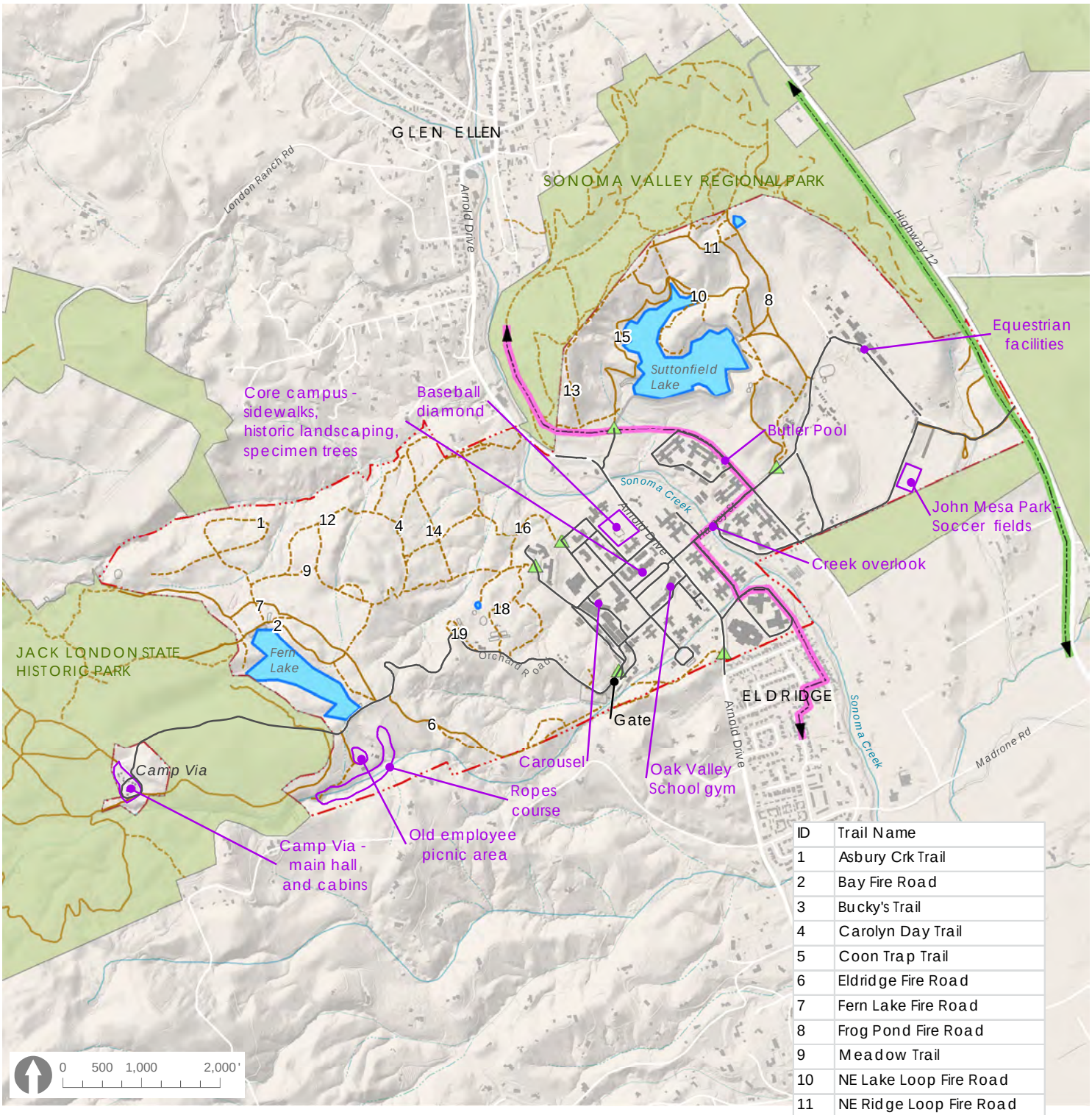


Exhibit 5

RECREATIONAL RESOURCES

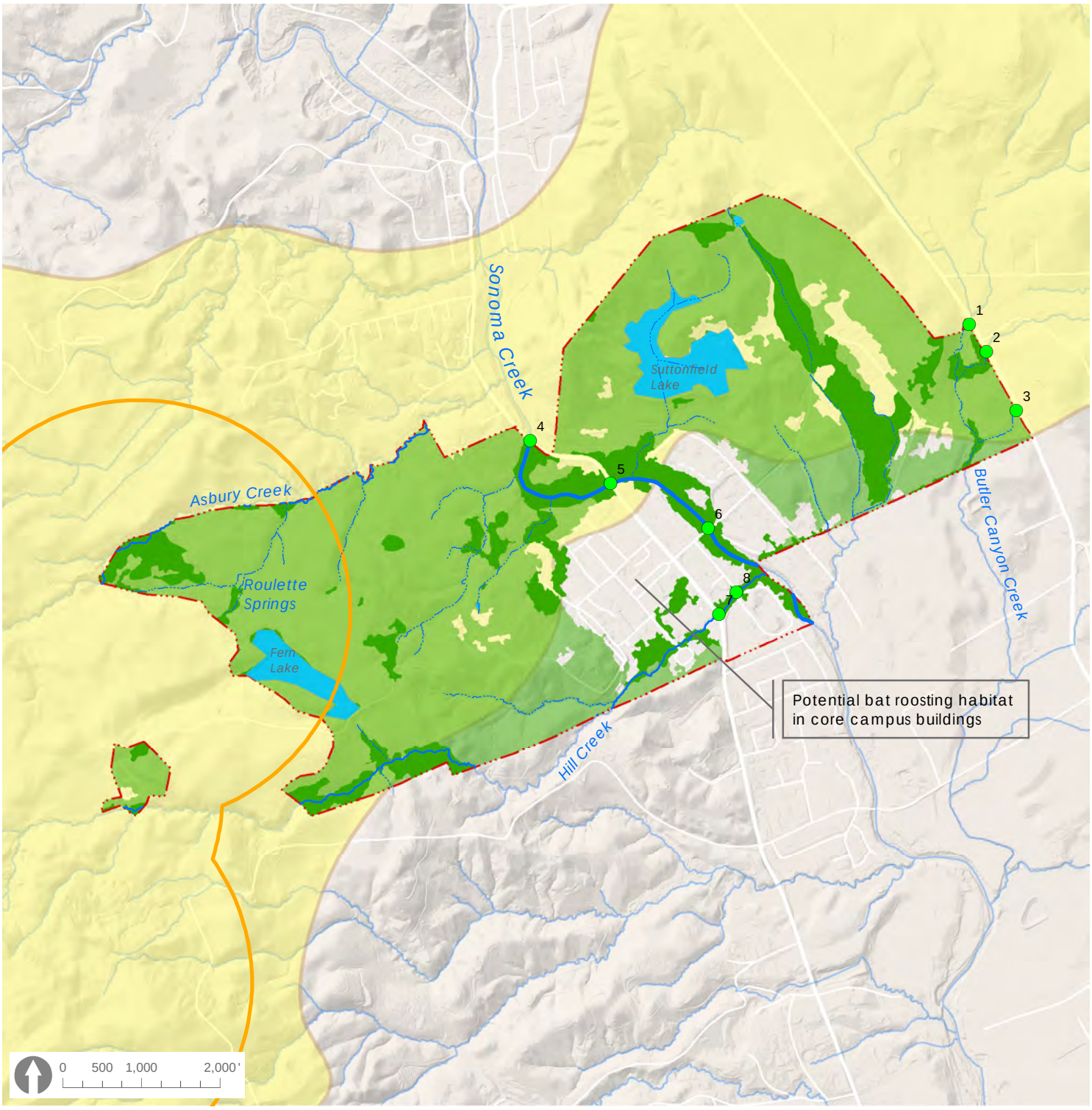


ID	Trail Name
1	Asbury Crk Trail
2	Bay Fire Road
3	Bucky's Trail
4	Carolyn Day Trail
5	Coon Trap Trail
6	Eldridge Fire Road
7	Fern Lake Fire Road
8	Frog Pond Fire Road
9	Meadow Trail
10	NE Lake Loop Fire Road
11	NE Ridge Loop Fire Road
12	North Boundary Trail
13	NW Ridge Trail
14	Pine Trail
15	Suttonfield Fire Road
16	Wagner Trail
17	Water Tank Trail
18	Water Tower Trail
19	Water Treatment Trail

Sources
USGS, GreenInfo Network,
Sonoma Ecology Center

Figure 6

SDC SENSITIVE NATURAL RESOURCES



SDC Property

Vegetation

- Sensitive vegetation types: riparian, wetland, redwood, valley oak, Oregon oak, madrone
- Other natural vegetation

Water Resources

- Sonoma Creek
- Hill and Asbury Creeks
- Seasonal streams
- Lakes and ponds

Wildlife Movement and Habitat

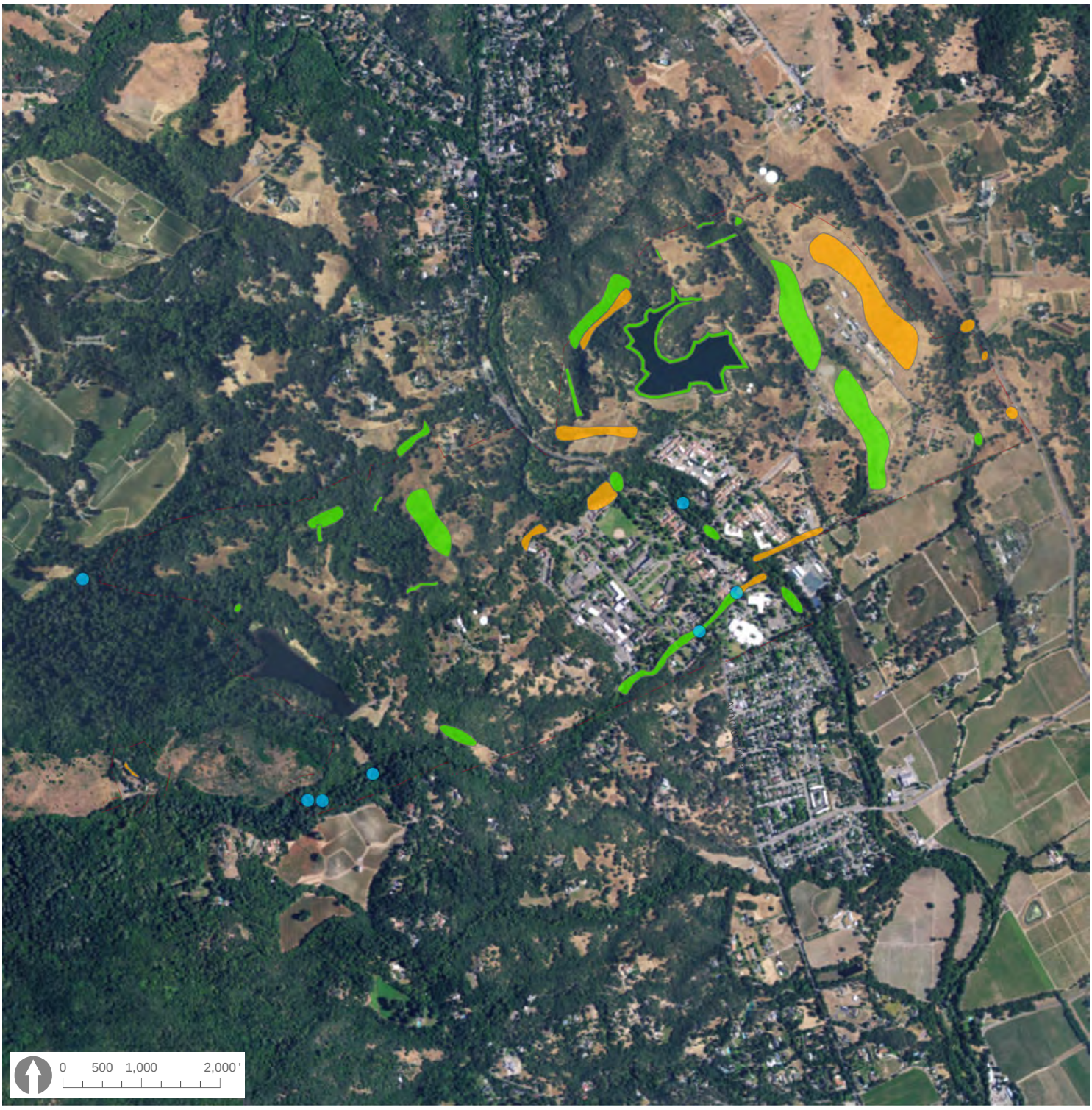
- Critical wildlife corridor
- Undercrossings (See text, Table 4.1)
- Northern spotted owl - 800 m buffer from known occurrences

Creeks, lakes, Roulette Springs, and redwood/fir forest provide habitat for multiple additional special-status wildlife species; see text.

Sources
CDFW (CNDDB), Sonoma Veg Map, Conservation Lands Network

Exhibit 7a

ECOLOGICAL ENHANCEMENT OPPORTUNITIES - OVERVIEW



SDC Property

Enhancement Opportunities

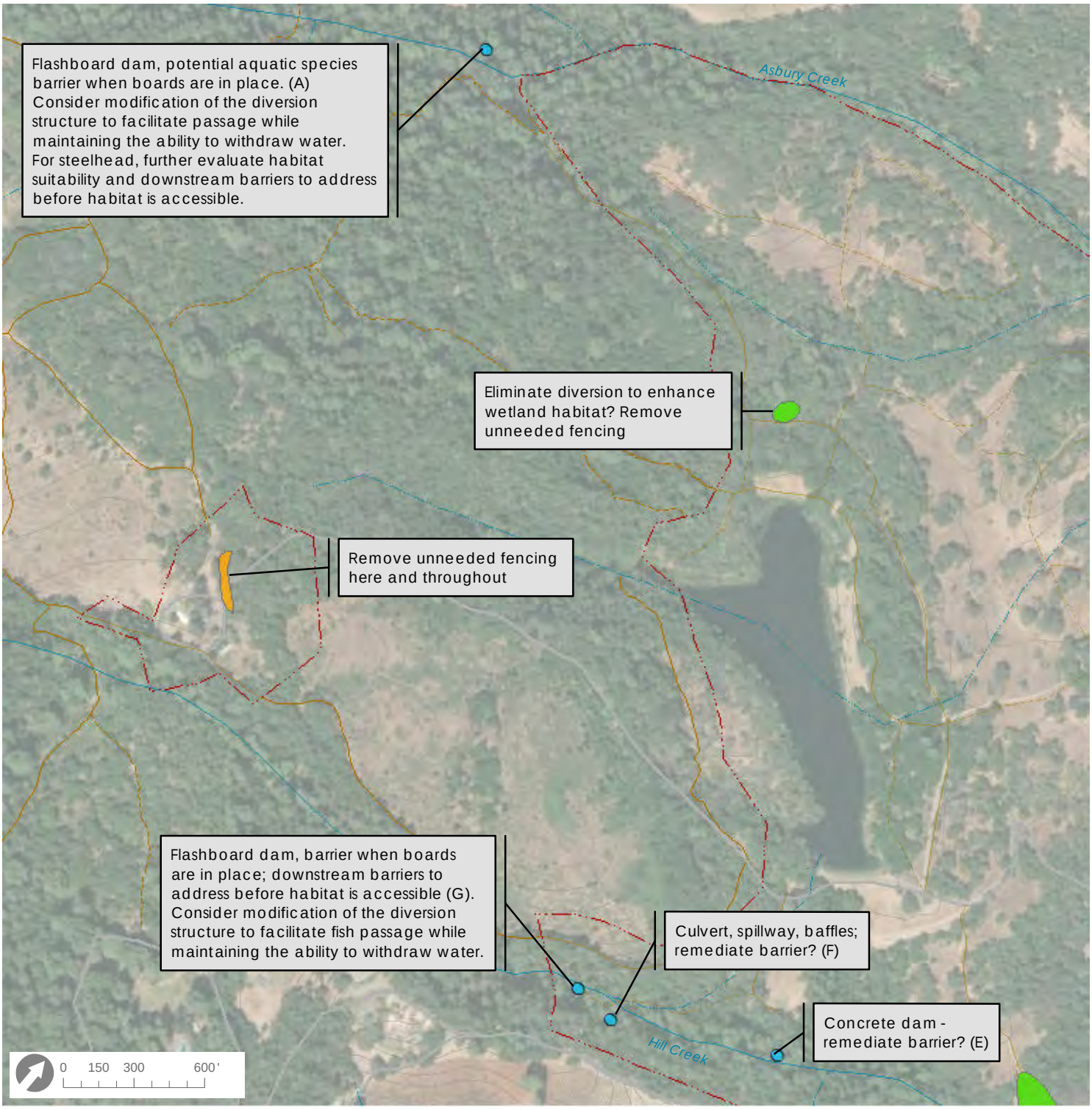
- Fish Passage
- General Habitat Enhancement
- Corridor/Wildlife Movement

Sources
ESRI, USGS, GreenInfo Network, Sonoma Ecology Center

Enhancement locations are approximate and not exhaustive. See text for discussion.

Exhibit 7b

ECOLOGICAL ENHANCEMENT OPPORTUNITIES - SDC WEST



SDC Property

Enhancement Opportunities

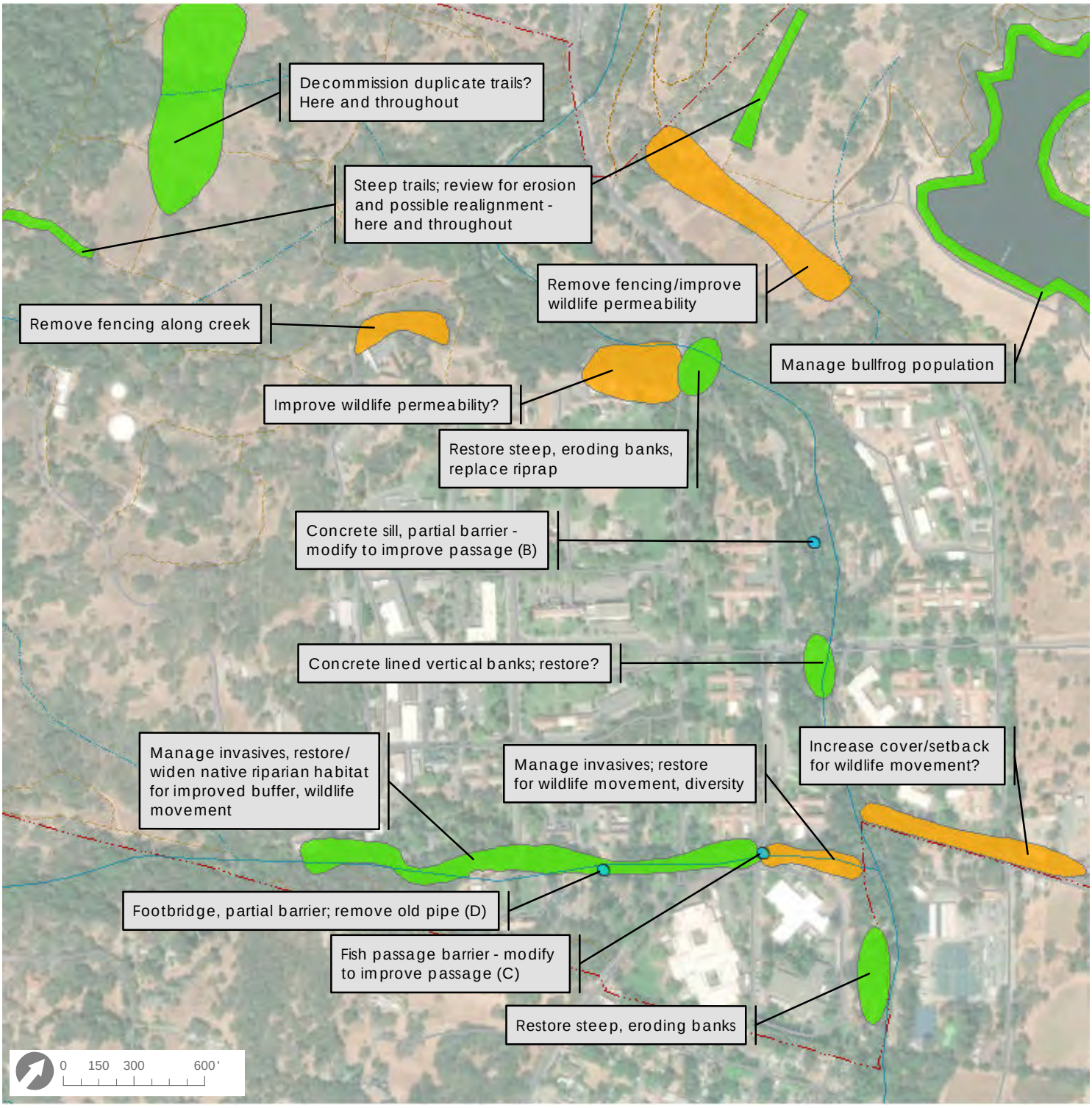
- Fish Passage
- General Habitat Enhancement
- Corridor/Wildlife Movement

See text for photos and additional information. (Letters in parentheses link to photos in Fish Passage Barriers section.)

Source
USGS

Exhibit 7c

ECOLOGICAL ENHANCEMENT OPPORTUNITIES - SDC CENTRAL



SDC Property

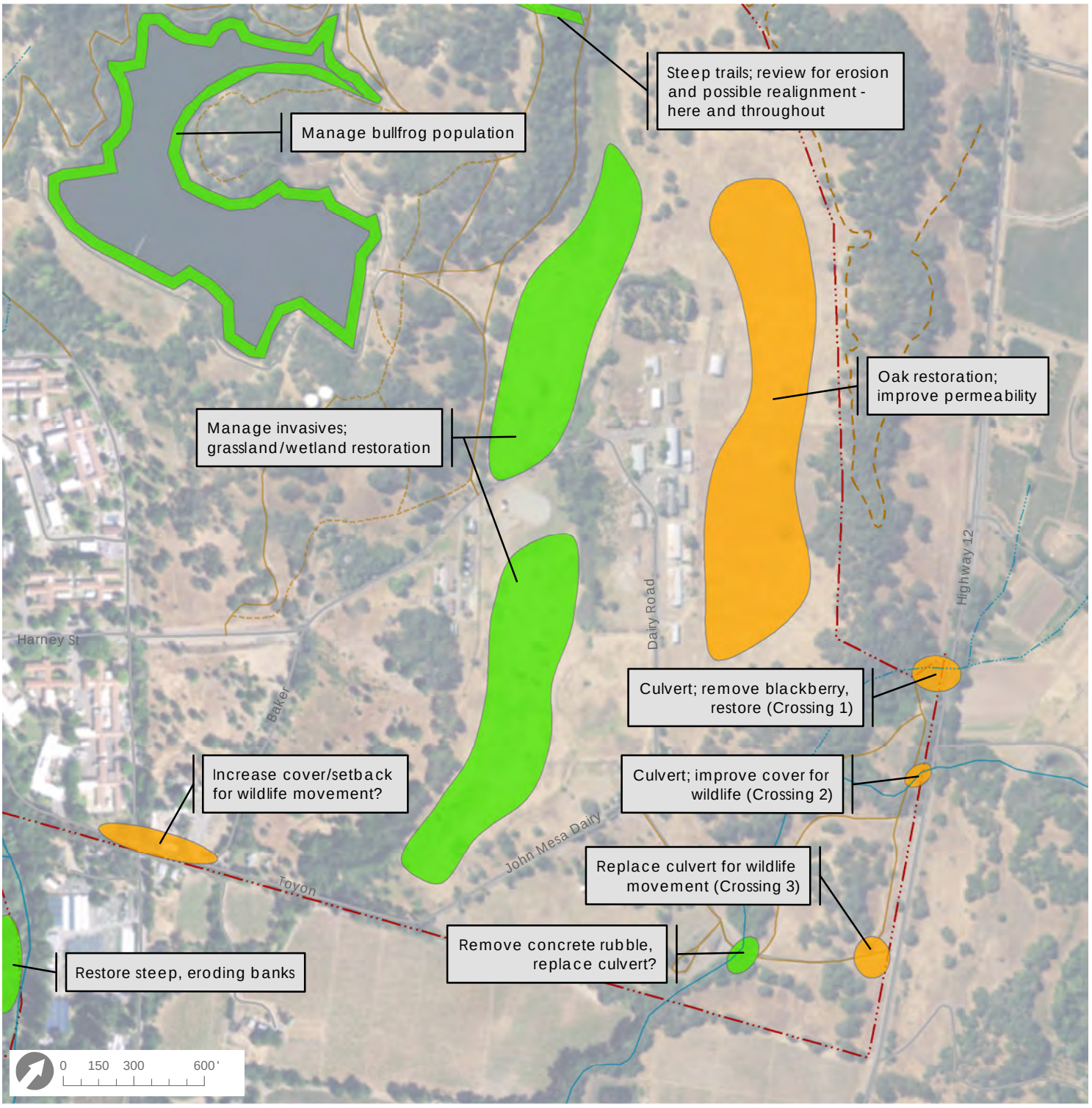
Enhancement Opportunities

- Fish Passage
- General Habitat Enhancement
- Corridor/Wildlife Movement

See text for photos and additional information. (Letters in parentheses link to photos in Fish Passage Barriers section.) See Figure 9 for recommended riparian setbacks relative to existing development and opportunities for increasing setbacks.

Exhibit 7d

ECOLOGICAL ENHANCEMENT OPPORTUNITIES - SDC EAST



SDC Property

General Habitat Enhancement

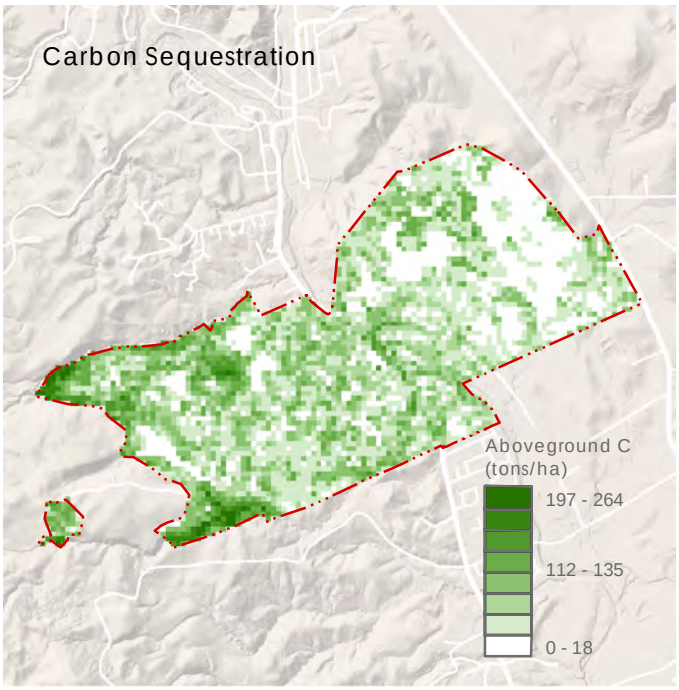
Corridor/Wildlife Movement

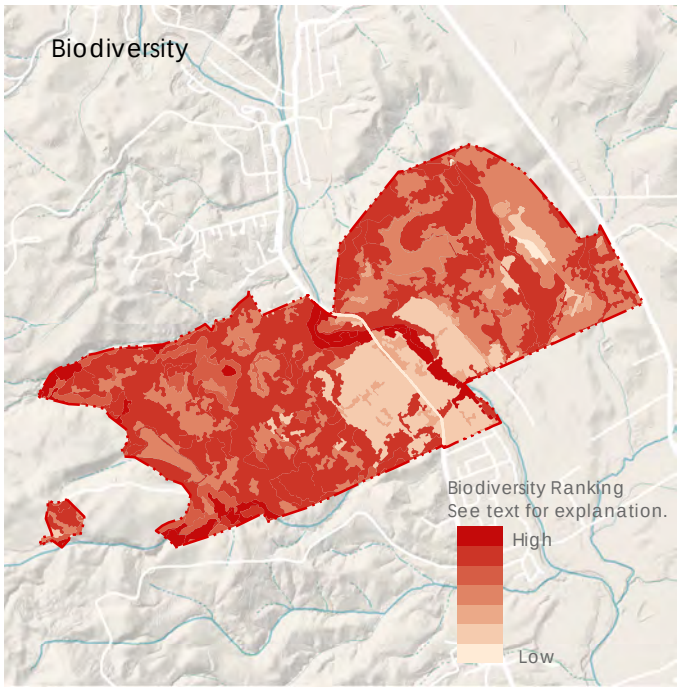
See text for photos and additional information. (Letters and numbers in parentheses link to text, Fish Passage Barriers and Wildlife Crossings sections.)

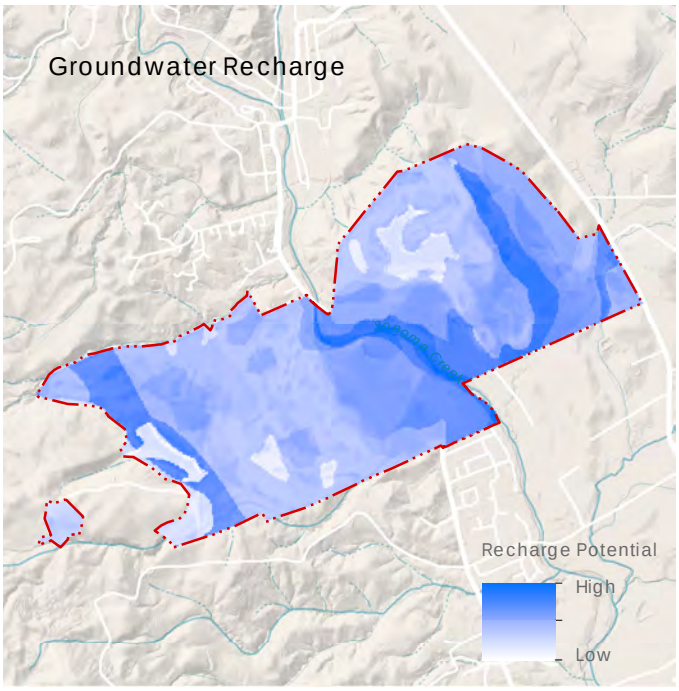
Source
USGS

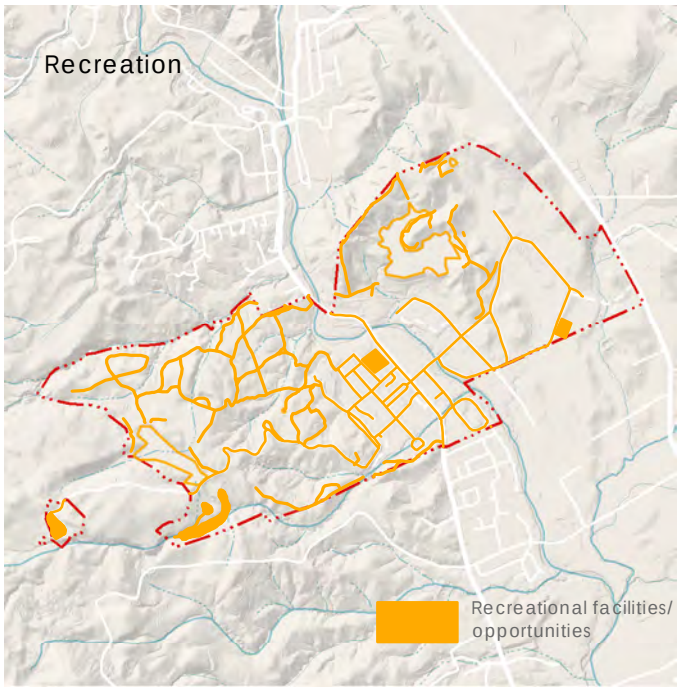
Exhibit 8

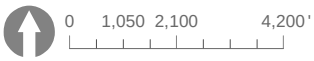
SELECTED ECOSYSTEM SERVICES











Sources
Carbon: Sonoma Veg Map
Recharge: SEC, SCWA
Biodiversity, Recreation: PCI

Exhibit 9

RIPARIAN BUFFERS AND EXISTING DEVELOPMENT - SDC CENTRAL

SDC Property
Buildings
Other impervious surfaces
Active channel - approximate
Active floodplain - approximate
50' Buffer
100' Buffer
300' Buffer

See text for discussion. Buffers shown are recommended distances for development from creek and vary with proposed and existing uses.

Appendices

A. Plant Species Observed on the Sonoma Developmental Center Property
B. Reptiles, Amphibians, and Mammals Observed or Potentially Occurring on the Sonoma Developmental Center Property
C. Bird Species Observed or Potentially Occurring on the Sonoma Developmental Center Property

Appendix A. Plant Species Observed on the Sonoma Developmental Center Property

Common Name	Scientific Name	Native (N) or Introduced (I); Invasive (*)
basket sedge	*Carex barbarae*	N
big leaf maple	*Acer macrophyllum*	N
black locust	*Robinia pseudoacacia*	I
black oak	*Quercus kelloggii*	N
blue oak	*Quercus douglasii*	N
blue wildrye	*Elymus glaucus*	N
blue-eyed grass	*Sisyrinchium bellum*	N
bracken fern	*Pteridium aquilinum var. pubescens*	N
bristly ox-tongue	*Helminthotheca echioides*	I
brownhead rush	*Juncus phaeocephalus*	N
bulrush, tule	*Schoenoplectus sp.*	N
California bay	*Umbellularia californica*	N
California blackberry	*Rubus ursinus*	N
California brome	*Bromus carinatus*	N
California buckeye	*Aesculus californica*	N
California buttercup	*Ranunculus californicus*	N
California fescue	*Festuca californica*	N
California honeysuckle	*Lonicera hispidula*	N
California milkwort	*Polygala californica*	N
California oatgrass	*Danthonia californica*	N
California polypody	*Polypodium californicum*	N
California poppy	*Eschscholzia californica*	N
cattail	*Typha sp.*	N
checker lily	*Fritillaria cf. affinis*	N
coast live oak	*Quercus agrifolia*	N
coffeeberry	*Frangula californica*	N
common fiddleneck	*Amsinckia intermedia*	N
common maidenhair fern	*Adiantum capillus-veneris*	N
common manzanita	*Arctostaphylos manzanita ssp. manzanita*	N
common meadowfoam	*Limnanthes douglasii*	N
common rush	*Juncus patens*	N
common spikerush	*Eleocharis macrostachya*	N
cotoneaster	*Cotoneaster pannosa*	I*
cow parsnip	*Heracleum lanatum*	N
coyote brush	*Baccharis pilularis*	N
creeping snowberry	*Symphoricarpos mollis*	N
creeping spikerush	*Eleocharis macrostachya*	N

Common Name	Scientific Name	Native (N) or Introduced (I); Invasive (*)
creeping wildrye	*Elymus triticoides*	N
curly dock	*Rumex crispus*	I
cutleaf geranium	*Geranium dissectum*	I
dogwood	*Cornus sp.*	N
Douglas fir	*Psuedotsuga menziesii var. menziesii*	N
Dutchman's pipevine	*Aristolochia californica*	N
elk clover	*Aralia californica*	N
English plantain	*Plantago lanceolata*	I
false lily of the valley	*Maianthemum racemosum*	N
farmer's foxtail	*Hordeum murinum ssp. leporinum*	I
fennel	*Foeniculum vulgare*	I*
Fernald's iris	*Iris fernaldii*	N
foothill needlegrass	*Stipa lepida*	N
Fremont cottonwood	*Populus fremontii*	N
French broom	*Genista monspessulana*	I*
giant reed	*Arundo donax*	I*
goldback fern	*Pentagramma triangularis*	N
gooseberry	*Ribes sp.*	N
hairy cat's ear	*Hypochaeris radicata*	I
Harding grass	*Phalaris aquatica*	I*
hazelnut	*Corylus cornuta var. californica*	N
hedge nettle	*Stachys ajugoides*	N
hedgehog dogtail grass	*Cynosurus echinatus*	I
Himalayan blackberry	*Rubus armeniacus*	I*
Horsetail	*Equisetum spp.*	N
hounds tongue	*Cynoglossum grande*	N
Indian warrior	*Pedicularis densiflora*	N
irisleaf rush	*Juncus phaeocephalus*	N
Italian ryegrass	*Festuca perenne*	I
Italian thistle	*Carduus pycnocephalus*	I
Ithuriel's spear	*Triteleia laxa*	N
Klamathweed	*Hypericum perforatum*	I*
knotweed	*Polygonum sp.*	varies
lady fern	*Athyrium filix-femina*	N
meadowfoam	*Limnanthes douglasii*	N
Mediterranean barley	*Hordeum marinum ssp. gussoneanum*	I
medusahead	*Elymus caput-medusae*	I*
milk maids	*Cardamine californica*	N
milkwort	*Polygala californica*	N

Common Name	Scientific Name	Native (N) or Introduced (I); Invasive (*)
miner's lettuce	*Claytonia perfoliata*	N
miniature lupine	*Lupinus bicolor*	N
mosquitofern	*Azolla filiculoides*	N
mountain mahogany	*Cercocarpus betuloides*	N
mugwort	*Artemisia douglasiana*	N
narrow-leaved mule's ears	*Wyethia angustifolia*	N
northern California black walnut	*Juglans hindsii*	N (special status for old stands; not applicable to this site)
one-sided bluegrass	*Poa secunda*	N
Oregon ash	*Fraxinus latifolia*	N
Oregon oak	*Quercus garryana*	N
Pacific madrone	*Arbutus menziesii*	N
Pacific rush	*Juncus effusus*	N
Pacific sanicle	*Sanicula crassicaulis*	N
panicled bulrush	*Scirpus microcarpus*	N
pennyroyal	*Mentha pulegium*	I*
poison hemlock	*Conium maculatum*	I*
poison oak	*Toxicodendron diversilobum*	N
purple clarkia	*Clarkia purpurea*	N
purple needlegrass	*Stipa pulchra*	N
purple vetch	*Vicia benghalensis*	I
rabbitsfoot grass	*Polypogon monspeliensis*	I
rat tail grass	*Festuca myuros*	I
red stemmed filaree	*Erodium cicutarium*	I
redwood (coast)	*Sequoia sempervirens*	N
ripgut brome	*Bromus diandrus*	I
Scotch broom	*Cytisus scoparius*	I*
scrub oak	*Quercus berberidifolia*	N
sedge	*Carex sp.*	N
sheep sorrel	*Rumex acetosella*	I
skunkweed	*Navarretia squarrosa*	N
sky lupine	*Lupinus nanus*	N
slender wild oat	*Avena barbata*	I
small-flowered melic	*Melica imperfecta*	N
small-flowered needlegrass	*Nassella lepida*	N
snowberry	*Symphoricarpos albus*	N
soaproot	*Chlorogalum pomeridianum var.*	N

Common Name	Scientific Name	Native (N) or Introduced (I); Invasive (*)
	pomeridianum	
soft chess	*Bromus hordeaceus*	I
spicebush	*Calycanthus occidentalis*	N
spinyfruit buttercup	*Ranunculus muricatus*	I
spreading rush	*Juncus patens*	N
spring vetch	*Vicia sativa*	I
sneezeweed	*Helenium puberulum*	N
sweet-cicely	*Osmorhiza chilensis*	N
sword fern	*Polystichum munitum*	N
tall flatsedge	*Cyperus eragrostis*	N
tan oak	*Notholithocarpus densiflorus var. densiflorus*	N
tarweed	*Madia sp.*	N
teasel	*Dipsacus sativus*	I*
thimbleberry	*Rubus parviflorus*	N
torrent sedge	*Carex nudata*	N
toyon	*Heteromeles arbutifolia*	N
valley oak	*Quercus lobata*	N
velvet grass	*Holcus lanatus*	I*
vinca	*Vinca major*	I*
water parsley	*Oenanthe sarmentosa*	N
water plantain	*Alisma sp.*	varies
watercress	*Nasturtium officinale*	N
western chain fern	*Woodwardia fimbriata*	N
western sword fern	*Polystichum munitum*	N
white alder	*Alnus rhombifolia*	N
white-flowered hawkweed	*Hieracium albiflorum*	N
wild hyacinth	*Dichelostemma capitatum*	N
wild oat	*Avena fatua*	I
wild plum	*Prunus cerasifera*	I*
wild radish	*Raphanus sativus*	I
willow	*Salix sp.*	N
willow, arroyo	*Salix lasiolepis*	N
willow, red	*Salix laevigata*	N
willow, sandbar	*Salix exigua*	N
willow, shining	*Salix lasiandra*	N
wire rush	*Juncus balticus*	N
wood fern	*Dryopteris arguta*	N
wood rose	*Rosa gymnocarpa*	N
woodland brome	*Bromus laevipes*	N

Common Name	Scientific Name	Native (N) or Introduced (I); Invasive (*)
yampah	*Perideridia sp.*	N
yarrow	*Achillea millefolium*	N
yellow mariposa lily	*Calochortus luteus*	N
yellow star thistle	*Centaurea solstitialis*	I*

Appendix B. Reptiles, Amphibians, and Mammals Observed or Potentially[1] Occurring on the Sonoma Developmental Center Property

Scientific Name	Common Name/Listing Status[2]
Reptiles[3]	
Actinemys marmorata[4]	**Northern Western Pond Turtle (under review for federal listing; SSC)**
Charina bottae	Northern Rubber Boa
Coluber constrictor mormon	Western Yellow-bellied Racer
Coluber lateralis lateralis	California Striped Racer (California Whipsnake)
Contia tenuis	Common Sharp-tailed Snake
Crotalus oreganus oreganus	Northern Pacific Rattlesnake
Diadophis punctatus amabilis	Pacific Ring-necked Snake
Elgaria coerulea coerulea	San Francisco Alligator Lizard (Northern Alligator Lizard)
Elgaria multicarinata multicarinata	California Alligator Lizard (Southern Alligator Lizard)
Lampropeltis californiae	California Kingsnake
Pituophis catenifer catenifer	Pacific Gopher Snake

[1] Wildlife species list is based on field surveys of SDC and regional occurrence information for the various taxa. Additional species may occur on the property and some may not be present; however, further surveys of the site would be needed to refine the list.

[2] Special-status species indicated in **bold**. Listing status from California Department of Fish and Wildlife's *Special Animals* dated July 2017 (Accessed at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109406&inline on 10/26/2017). Listing Status: Federal = FE-federally listed as endangered, FT-federally listed as threatened, BCC-Bird of Conservation Concern; State = SE-State-listed as endangered, ST-State-listed as threatened, Candidate ST-State candidate to be listed as threatened under CESA, FP-State of California fully-protected species, SSC-California Species of Special Concern, and WL-Watch List; Western Bat Working Group (WBWG) - Low (L), Medium (M), and High (H) priority ranks.

[3] Common and scientific names for reptiles and amphibians obtained from Californiaherps - *A Guide to the Amphibians and Reptiles of California* (Accessed: http://www.californiaherps.com/ on 10/26/2017), which follows published listed by the Society for the Study of Amphibians and Reptiles. Species listed in alphabetical order.

* Non-native species.

Scientific Name	Common Name/Listing Status[2]
Plestiodon skiltonianus skiltonianus	Skilton's Skink
Sceloporus occidentalis bocourtii/ occidentalis	Western Fence Lizard
Thamnophis atratus (integrades)	Aquatic Gartersnake
Thamnophis elegans terrestris	Coast Gartersnake
Thamnophis sirtalis infernalis	California Red-sided Gartersnake (Common Gartersnake)
Amphibians	
Anaxyrus boreas halophilus	California Toad (Western Toad)
Aneides flavipunctatus flavipunctatus	Speckled Black Salamander (at extreme south of its range, occurrence questionable)
Aneides lugubris	Arboreal Salamander
Batrachoseps attenuatus	California Slender Salamander
Dicamptodon ensatus	**California Giant Salamander (SSC)**
Ensatina eschscholtzii oregonensis	Oregon Ensatina
Lithobates catesbeianus	American Bullfrog*
Pseudacris sierra	Sierran Treefrog
Rana boylii	**Foothill Yellow-legged Frog (Candidate ST, SSC)**
Rana draytonii	**California Red-legged Frog (FT, SSC)**
Taricha granulosa	Rough-skinned Newt
Taricha torosa	California Newt
Taricha rivularis	**Red-bellied Newt (SSC)**

Scientific Name	Common Name/Listing Status[2]
Mammals[5]	
Antrozous pallidus	**Pallid Bat (SSC, WBWG - H)**
Bassariscus astutus	**Ringtail (FP)**
Canis latrans	Coyote
Castor canadensis	Beaver
Corynorhinus townsendii	**Townsend's Big-eared Bat (SSC, WBWG - H)**
Didelphis virginiana	Virginia Opossum*
Dipodomys californicus	California Kangaroo Rat
Eptesicus fuscus	Big Brown Bat
Erethizon dorsatum	Common Porcupine
Lasionycteris noctivagans	**Silver-haired Bat (WBWG - M)**
Lasiurus blossevillii	**Western Red Bat (SSC, WBWG - H)**
Lasiurus cinereus	**Hoary Bat (WBWG - M)**
Lepus californicus	Black-tailed Jackrabbit
Lontra canadensis	Northern River Otter
Lynx rufus	Bobcat
Mephitis mephitis	Striped Skunk
Microtus californicus	California Vole

[5] Mammal list based on regional occurrence information from American Society of Mammologists – *Mammalian Species* (Accessed at: http://www.mammalsociety.org/publications/mammalian-species on 10/26/2017). Species listed in alphabetical order.
A number of non-native mammals are not included here, but may occur on SDC and/or surrounding areas. These include non-native mice, rats, fox squirrel, and red fox. Native black bears are occasionally reported in Sonoma Valley, a black bear was spotted on Hood Mountain Regional Park in August 2017. However, they are fairly uncommon and not expected on SDC with any regularity.

Scientific Name	Common Name/Listing Status[2]
Mustela erminea	Short-tailed Weasel (Ermine)
Mustela frenata	Long-tailed Weasel
Myotis californicus	California Myotis
Myotis evotis	**Long-eared Myotis (WBWG - M)**
Myotis lucifugus	Little Brown Myotis
Myotis thysanodes	**Fringed Myotis (WBWG - H)**
Myotis volans	**Long-legged Myotis (WBWG - H)**
Myotis yumanensis	**Yuma Myotis (WBWG - LM)**
Neotoma fuscipes	Dusky-footed Woodrat
Neurotrichus gibbsii	Shrew-mole
Odocoileus hemionus	Black-tailed Deer
Otospermophilus beecheyi	California Ground Squirrel
Peromyscus boylii	Brush Deermouse
Peromyscus maniculatus	North American Deermouse
Procyon lotor	Raccoon
Puma concolor	Mountain Lion[6]
Reithrodontomys megalotis	Western Harvest Mouse
Scapanus latimanus	Broad-footed Mole
Sciurus griseus	Western Grey Squirrel
Sorex trowbridgii	Trowbridge's Shrew
Sorex vagrans	Vagrant Shrew

[6] Mountain lions are protected under the California Wildlife Protection Act of 1990 (Proposition 117) and designated as a "specially protected mammal in California".

Scientific Name	Common Name/Listing Status[2]
Spilogale gracilis	Spotted Skunk
Sylvilagus bachmani	Brush Rabbit
Tadarida brasiliensis	Brazilian (or Mexican) Free-tailed Bat
Tamias sonomae	Sonoma Chipmunk
Thomomys bottae	Botta's Pocket Gopher
Urocyon cinereoargenteus	Gray Fox

Appendix C. Bird Species Observed or Potentially[7] Occurring on the Sonoma Developmental Center Property

Scientific Name	Common Name/Listing Status[2]	BBA[8] 1986-1991	BBA 2011-2016	CBC[9]	Citizen Science Bird Surveys[10]	Ebird[11]	PCI[12]
Branta canadensis	Canada Goose		CO	X	X	X	X
Branta hutchinsii	Cackling Goose					X	
Aix sponsa	Wood Duck		CO			X	
Anas platyrhynchos	Mallard	CO	CO	X	X	X	X
Anas americana	American Wigeon			X	X		
Bucephala albeola	Bufflehead			X	X		

[7] Bird species list is based on field surveys of SDC and regional occurrence information. Additional species may occur on the property and some may not be present; however, further surveys of the site would be needed to refine the list. Common and scientific names for birds follows American Ornithologists' Union (AUO) Committee on Classification and Nomenclature. Species listed in taxonomic order.

[8] SDC was part of a county-wide effort to document all breeding birds from 2011-2016, the Sonoma County Breeding Bird Atlas (BBA) project. A similar effort was completed 20 years ago (Burridge ed., 1995). Both of these surveys were sponsored by Madrone Audubon Society. Breeding Bird Atlas data included for the Sonoma Mountain, Agua Caliente, and Glen Ellen blocks (Burridge ed., 1995; USGS, 2017). SDC is located within or adjacent to these blocks. Breeding code descriptions: PO = possible breeding, PR = probable breeding, and CO = confirmed breeding. Most inclusive breeding code indicated for each species documented in the blocks.

[9] The Glen Ellen area, including SDC, is part of the Sonoma Valley Christmas Bird Count (CBC), a nationwide winter bird survey over a two-week period around Christmas which documents species composition and numbers of birds. During the counts, a group of birders record the number of individual birds observed in a given area over a one-day period. CBC data reported for 2015 for the Glen Ellen area, which includes SDC. Data obtained from Richard Dale, Sonoma Ecology Center.

[10] With the support of SLT and SEC, a citizen science wildlife survey effort was initiated on SDC to establish baseline data on birds and other wildlife. The effort was spearheaded by members of the Redwood Regional Ornithological Society. Surveys of the property were completed once every two months with groups of individuals assigned to one of five areas on SDC. Surveyors tracked the abundance of species throughout the cycle of the seasons. Results from nine separate surveys completed from October 2014 through January 2015 are included (Hunn 2015).

[11] Ebird (Accessed at: http://ebird.org/content/ebird/ on 10/26/2017) sightings for Sonoma Developmental Center lands west of Arnold Drive including Fern Lake.

* Non-native species.

[12] Birds observed by PCI in 2017.

Scientific Name	Common Name/Listing Status[2]	BBA[8] 1986-1991	BBA 2011-2016	CBC[9]	Citizen Science Bird Surveys[10]	Ebird[11]	PCI[12]
Bucephala clangula	Common Goldeneye			X	X	X	
Lophodytes cucullatus	Hooded Merganser			X	X		
Mergus merganser	Common Merganser		PR				
Oxyura jamaicensis	Ruddy Duck				X		
Aix galericulata	Mandarin Duck*		PR				
Callipepla californica	California Quail	CO	CO	X	X	X	X
Oreortyx pictus	Mountain Quail	CO					
Meleagris gallopavo	Wild Turkey*		CO		X	X	X
Podilymbus podiceps	Pied-billed Grebe		CO	X	X	X	
Aechmophorus occidentalis	Western Grebe			X	X		
Phalacrocorax auritus	**Double-crested cormorant - WL**			X	X	X	
Ardea herodias	Great Blue Heron		CO	X		X	X
Ardea alba	Great Egret			X	X		
Butorides virescens	Green Heron	CO	PO				
Cathartes aura	Turkey Vulture	CO	CO	X	X	X	X
Elanus leucurus	**White-tailed Kite - FP**	PR	PO	X			
Aquila chrysaetos	**Golden Eagle - BCC, FP, WL**	PR	PR				
Accipiter striatus	**Sharp-shinned Hawk - WL**	PO				X	
Accipiter cooperii	**Cooper's Hawk - WL**	PO	PR	X	X	X	X

Scientific Name	Common Name/Listing Status[2]	BBA[8] 1986-1991	BBA 2011-2016	CBC[9]	Citizen Science Bird Surveys[10]	Ebird[11]	PCI[12]
Buteo lineatus	Red-shouldered Hawk	CO	CO	X	X	X	X
Buteo jamaicensis	Red-tailed Hawk	CO	CO	X	X	X	X
Falco sparverius	American Kestrel	CO	CO	X	X	X	X
Falco columbarius	**Merlin - WL**			X			
Falco peregrinus	**Peregrine Falcon - BCC, FP**		CO			X	
Rallus limicola	Virginia Rail	PO	CO				
Fulica americana	American Coot	CO	CO		X		
Charadrius vociferus	Killdeer	PO	PR		X		
Gallinago delicata	Wilson's Snipe				X		
Columba fasciata	Band-tailed Pigeon	PR	PR	X			
Columba livia	Rock Pigeon*		CO	X	X		X
Streptopelia decaocto	Eurasian Collard-dove*		PR	X	X		X
Zenaida macroura	Mourning Dove	CO	PR	X	X	X	X
Tyto alba	Barn Owl		PO				
Bubo virginianus	Great Horned Owl	PR	CO				
Strix occidentalis	**Northern Spotted Owl - FT, ST, SSC**	PR	Present based on LSA (2001) findings				
Otus kennicottii	Western Screech-owl	CO	CO				
Glaucidium gnoma	Northern Pygmy-owl	PO	PR		X		
Strix varia	Barred Owl*		PR				

Scientific Name	Common Name/Listing Status[2]	BBA[8] 1986-1991	BBA 2011-2016	CBC[9]	Citizen Science Bird Surveys[10]	Ebird[11]	PCI[12]
Aegolius acadicus	Northern Saw-whet Owl	Not reported, but likely in redwood & fir habitats					
Chaetura vauxi	**Vaux's Swift - SSC**		CO	Documented roosting in building on SDC McDonald (2015)			
Aeronautes saxatalis	White-throated Swift	PR					
Calypte anna	Anna's Hummingbird	CO	CO	X	X	X	X
Selasphorus sasin	**Allen's Hummingbird - BCC**	CO	PR				
Ceryle alcyon	Belted Kingfisher	PO	CO	X	X	X	X
Melanerpes formicivorus	Acorn Woodpecker	CO	CO	X	X	X	X
Sphyrapicus ruber	Red-breasted Sapsucker			X	X	X	
Picoides nuttalli	**Nuttall's Woodpecker - BCC**	CO	CO	X	X	X	X
Picoides villosus	Hairy Woodpecker	PO	PO	X	X		
Picoides pubescens	Downy Woodpecker	CO	CO	X		X	X
Colaptes auratus	Northern Flicker	CO	PR	X	X	X	X
Dryocopus pileatus	Pileated Woodpecker	CO	CO	X	X	X	X
Contopus cooperi	**Olive-sided Flycatcher - BBC, SSC**	PR					
Contopus sordidulus	Western Wood-pewee	PR	CO			X	X
Empidonax difficilis	Pacific-slope Flycatcher	CO	CO			X	X
Sayornis nigricans	Black Phoebe	CO	CO	X	X	X	X

Scientific Name	Common Name/Listing Status[2]	BBA[8] 1986-1991	BBA 2011-2016	CBC[9]	Citizen Science Bird Surveys[10]	Ebird[11]	PCI[12]
Sayornis saya	Say's Phoebe			X	X		
Myiarchus cinerascens	Ash-throated Flycatcher	CO	CO			X	X
Tyrannus verticalis	Western Kingbird	CO					
Lanius ludovicianus	**Loggerhead Shrike - BBC, SSC**	PO					
Vireo cassinii	Cassin's Vireo	CO	CO			X	
Vireo huttoni	Hutton's Vireo	CO	CO		X	X	
Vireo gilvus	Warbling Vireo	CO	CO			X	
Cyanocitta stelleri	Steller's Jay	CO	CO	X	X	X	X
Aphelocoma californica	Western Scrub-jay	CO	CO	X	X	X	X
Corvus brachyrhynchos	American Crow	CO	CO	X	X	X	X
Corvus corax	Common Raven	CO	CO	X	X	X	X
Eremophila alpestris	**Horned Lark - WL**	PR					
Tachycineta bicolor	Tree Swallow	PO	CO			X	X
Tachycineta thalassina	Violet-green Swallow	CO	CO			X	X
Hirundo rustica	Barn Swallow	CO	CO				
Stelgidopteryx serripennis	Northern Rough-winged		CO				
Petrochelidon pyrrhonota	Cliff Swallow	CO	CO				
Baeolophus inornatus	**Oak Titmouse - BCC**	CO	CO	X	X	X	X

Scientific Name	Common Name/Listing Status[2]	BBA[8] 1986-1991	BBA 2011-2016	CBC[9]	Citizen Science Bird Surveys[10]	Ebird[11]	PCI[12]
Poecile rufescens	Chestnut-backed Chickadee	CO	CO	X	X	X	X
Psaltriparus minimus	Bushtit	CO	CO	X	X	X	X
Sitta canadensis	Red-breasted Nuthatch		PO				
Sitta carolinensis	White-breasted Nuthatch	CO	CO	X	X	X	X
Certhia americana	Brown Creeper	CO	CO	X	X	X	X
Salpinctes obsoletus	Rock Wren	PR	CO				
Troglodytes aedon	House Wren	CO	CO			X	
Troglodytes pacificus	Pacific Wren				X		
Thryomanes bewickii	Bewick's Wren	CO	CO	X	X	X	X
Regulus calendula	Ruby-crowned Kinglet			X	X	X	
Chamaea fasciata	**Wrentit - BCC**	CO	CO	X			
Polioptila caerulea	Blue-gray Gnatcatcher	CO	CO			X	
Sialia mexicana	Western Bluebird	CO	CO	X	X	X	X
Catharus ustulatus	Swainson's Thrush	PO	PO				
Catharus guttatus	Hermit Thrush			X	X	X	
Turdus migratorius	American Robin	CO	CO	X	X	X	X
Ixoreus naevius	Varied Thrush			X	X		
Mimus polyglottos	Northern Mockingbird	PO	CO	X	X		X
Toxostoma redivivum	**California Thrasher - BCC**	PO					

Scientific Name	Common Name/Listing Status[2]	BBA[8] 1986-1991	BBA 2011-2016	CBC[9]	Citizen Science Bird Surveys[10]	Ebird[11]	PCI[12]
Sturnus vulgaris	European Starling *	CO	CO	X	X	X	X
Bombycilla cedrorum	Cedar Waxwing						
Vermivora celata	Orange-crowned Warbler	PR	CO			X	X
Setophaga petechia	**Yellow Warbler - BCC, SSC**	PO	PR				
Dendroica coronata	Yellow-rumped Warbler			X	X	X	
Dendroica nigrescens	Black-throated Gray Warbler	PR					
Setophaga occidentalis	Hermit Warbler		PO				
Dendroica townsendi	Townsend's Warbler			X	X	X	
Wilsonia pusilla	Wilson's Warbler	PR	CO			X	X
Pipilo maculatus	Spotted Towhee	CO	CO	X	X	X	X
Pipilo crissalis	California Towhee	CO	CO	X	X	X	X
Aimophila ruficeps	Rufous-crowned Sparrow	PO					
Spizella passerina	**Chipping Sparrow**	CO	CO				
Amphispiza belli	Sage Sparrow	CO					
Passerculus sandwichensis alaudinus	**Bryant's Savannah Sparrow**	PO		X			
Ammodramus savannarum	**Grasshopper Sparrow**	PO					
Chondestes grammacus	**Lark Sparrow**	CO	CO				

Scientific Name	Common Name/Listing Status[2]	BBA[8] 1986-1991	BBA 2011-2016	CBC[9]	Citizen Science Bird Surveys[10]	Ebird[11]	PCI[12]
Melospiza lincolnii	Lincoln's Sparrow				X	X	
Melospiza melodia	Song Sparrow	CO	CO	X	X	X	X
Passerella iliaca	Fox Sparrow			X	X		
Zonotrichia albicollis	White-throated Sparrow				X		
Zonotrichia leucophrys	White-crowned Sparrow			X	X	X	
Zonotrichia atricapilla	Golden-crowned Sparrow			X	X	X	
Junco hyemalis	Dark-eyed Junco	CO	CO	X	X	X	X
Piranga ludoviciana	Western Tanager	PR	CO			X	
Pheucticus melanocephalus	Black-headed Grosbeak	CO	CO			X	X
Passerina amoena	Lazuli Bunting	CO	PR				
Sturnella neglecta	Western Meadowlark	PO	PO	X	X		
Agelaius phoeniceus	Red-winged Blackbird	CO	CO	X	X	X	X
Euphagus cyanocephalus	Brewer’s Blackbird	CO	CO				X
Molothrus ater	Brown-headed Cowbird	PR	PO				X
Icterus bullockii	Bullock's Oriole	CO	PR				
Carpodacus purpureus	Purple Finch	CO	CO	X	X	X	
Carpodacus mexicanus	House Finch	CO	CO	X	X	X	X
Carduelis tristis	American Goldfinch	PR		X	X		X
Carduelis psaltria	Lesser Goldfinch	CO	CO		X	X	
Carduelis pinus	Pine Siskin			X			

Scientific Name	Common Name/Listing Status[2]	BBA[8] 1986-1991	BBA 2011-2016	CBC[9]	Citizen Science Bird Surveys[10]	Ebird[11]	PCI[12]
Passer domesticus	House Sparrow*	PR	CO	X	X		X