San Lorenzo Valley Water District

Watershed Management Plan

Part III: Planning & Recommendations Report

Section 1: Management Alternatives & Prescriptions on District Lands

Chapter 2

- Olympia Watershed -

Ken Moore 2009

Final draft

June 21, 2012

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ACKNOWLEDGMENTS

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CHAPTER 2: OLYMPIA WATERSHED PROPERTY

2.0 Introduction

The planning and recommendations report for the Olympia Watershed property addresses the following topics:

- Overview of the site (Section 2.1)
- Hydrology, Geomorphology, and Water Quality (Section 2.2)
- Biotic Resources (Section 2.3)
- Fire Management (Section 2.4)
- Recreational Resources (Section 2.5)
- Educational Resources (Section 2.6)
- Cultural and Historical Resources (Section 2.7)
- Climate Change (Section 2.8)
- Appendix A: Summary of management alternatives & recommended measures

All prescribed management activities on the Olympia Watershed must meet the District's primary goal of watershed management:

> *Manage District watershed lands to protect and enhance ecosystem health and water quality, while managing District water sources to provide a reliable water supply in perpetuity.*

In addition, all prescribed management activities must meet other secondary goals, as applicable to each section. Please refer to Appendix A at the end of this chapter for a summary of management alternatives and recommended measures.

2.1 Overview of the site

This section provides a brief site history, site description and an overview of the existing conditions and management issues on the Olympia Watershed (also see Existing Conditions Report, Chapters 3-6).

2.1.2 Site history

The following brief time-line of the Olympia watershed property identifies some reference points in its land use history:

- 1880 Zayante Rancho vineyards, orchards (RTD, 2009)
- 1937-1960s Olympia sand pit quarry operation installs conveyor belts, settling ponds, mining equipment, railroad spur (RTD, 2009)
- 1977 District purchases 163 acres to be used as a wellfield to supply groundwater to District customers in the North system
- 1981 District's first production well established
- 1985 District approves its Watershed Protection Plan, which applies to all District property
- 1988 District signs its first agreement with the Santa Cruz County Horseman's Agreement to allow equestrian use of portions of the property
- 2000 District engages in its first effort to control acacia

- 2002 District grants Mayer conservation easement on a small portion of high quality sand parkland of the property to Center for Natural Lands Management
- 2007 District approves Watershed Management Plan Existing Conditions Report
- 2009 District purchases 17 acres known as the Ferrari property
- 2009 District conducts environmental site assessment of the Ferrari property
- 2009 District is awarded its first Weed Management Area grant to control acacia
- 2009 District is awarded a U. S. Fish and Wildlife Service Partners Grant to control acacia and broom on the newly acquired Ferrari property
- 2010 District is awarded a Weed Management Area supplemental grant to continue acacia and broom control throughout the Olympia Watershed property
- 2011 Board approves Resolution 34 approving limited recreational use on the property
- 2011 District completes fencing of service roads defining limited recreational uses on the property
- 2011 Board approves debris storage and management improvement plan
- 2012 District implements improvements to utility yard, removes and recycles old pond liner tarps
- 2012 District completes administrative draft of implementation plan for the Olympia Watershed property

2.1.3 Site description

The Olympia Watershed's value as a groundwater source was the District's sole reason for purchasing the property. The sandy soils overlaying the Santa Margarita sandstone aquifer provide ideal recharge conditions, and the surrounding areas are relatively undeveloped. The property's legacy of quarrying, fire suppression, and recreational disturbance has fragmented and degraded natural plant and animal communities. These disturbances opened the door to a host of exotic plant species, which have aggressively invaded the property, depriving native species of nutrients and habitat, and potentially threatening the existing ecosystem (Existing Conditions Report, Chapter 3, paragraph 3.6)

Despite all of these issues, the Olympia Watershed property remains remarkably effective as a groundwater source, it continues to host extremely rare plant and animal communities, and it remains inviting to recreational use.

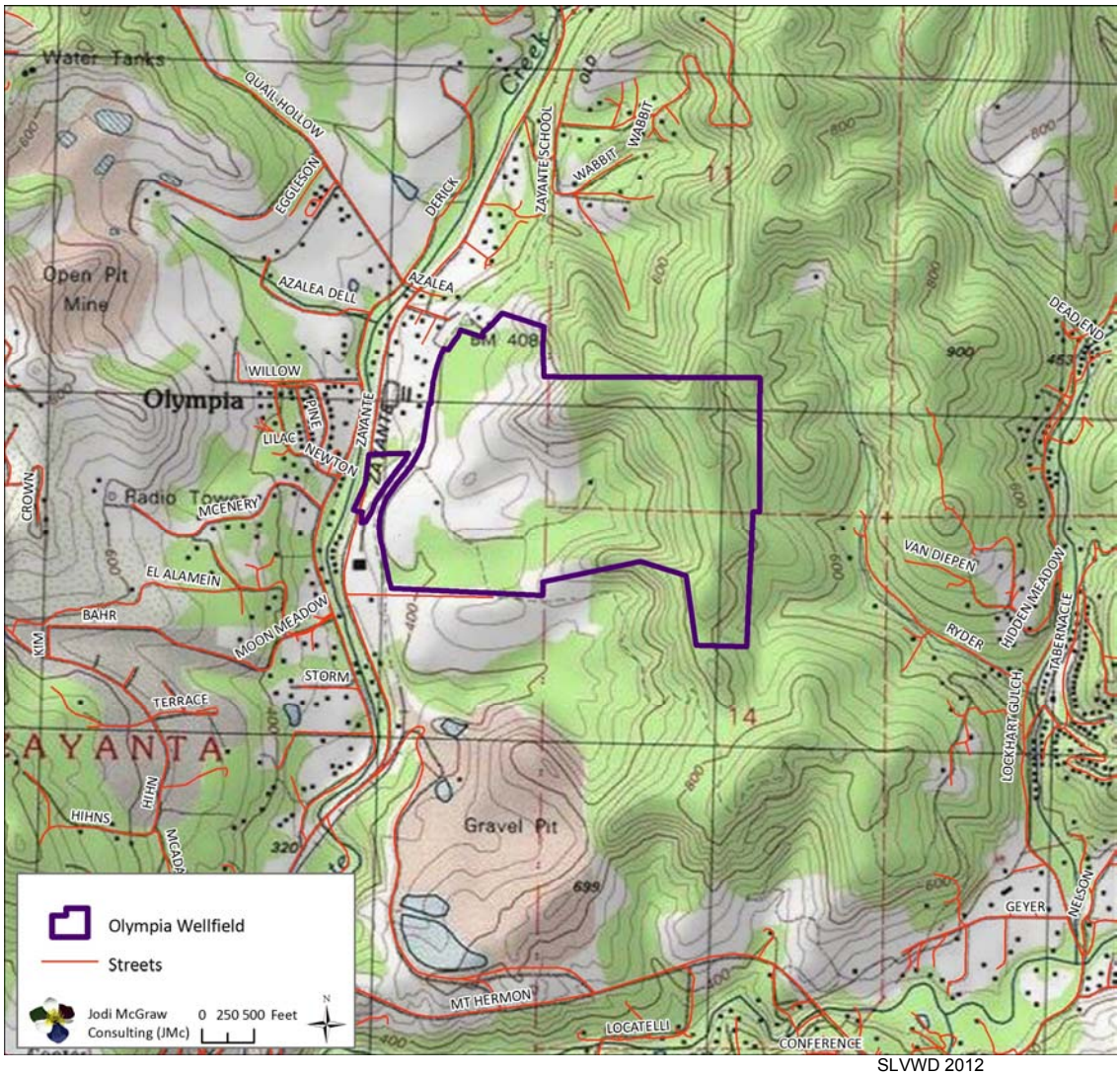
2.1.2.a Boundaries and location

The Olympia Watershed property, also known as the Olympia Wellfield, comprises approximately 180 acres of land north of Felton near Zayante Creek. Figure 2-1 indicates the boundaries of the District-owned Olympia watershed property outlined in purple on a USGS topographic map and neighboring properties.

The western boundary of the property is roughly parallel to E. Zayante Rd., with Roaring Camp Railroad lines immediately adjacent to the western boundary. Zayante fire station and the Zayante Equestrian Center are also located at the western boundary. To the south are the Morgan (formerly Geyer) property, owned by Land Trust of Santa Cruz County, and the Cemex quarry.

To the east, the Olympia watershed is bounded by private property along Ryder Rd. and Lockhart Gulch Rd. and to the north along Olympia Station Rd. and Zayante School Rd.

Figure 2-1. Olympia Watershed property boundaries



SLVWD 2012

Boundaries of the District-owned Olympia watershed property outlined in purple on a USGS topo map.

2.1.3.b Identified sensitive areas

Santa Cruz County lists the site as being situated in a water supply watershed, a groundwater recharge area, a riparian zone, a biotic resource area, an archaeological resource, and a fire hazard zone (RTD, 2009). The District purchased the Olympia Watershed property because of its great value as a groundwater source to supplement the District's surface water supplies.

2.1.3.c Topography and geology

The Olympia Watershed property contains two distinct areas, in terms of topography, geology, and soils. The western portion of the property is relatively flat and open, averaging approximately 400 feet in elevation, with sandy soils. The eastern portion of the property is steeply sloped, rising to more than 900 feet in elevation.

Figure 2-1 shows that the western half of the Olympia watershed property is flat to sloping, with a maximum elevation of ~ 434 ft. The eastern half of the property is more steeply sloped to a maximum elevation of ~ 920 ft.

The District wells on the Olympia watershed property tap the Santa Margarita Sandstone aquifer, the major aquifer supplying both the District and the Scotts Valley Water District. Groundwater recharge is derived primarily from percolating rainfall. The recharge area for these wells is largely rural and undeveloped. Land use in the recharge area includes a closed sand quarry, undeveloped open space including timberland, and rural residential development. Because of its recharge capacity, Olympia groundwater levels have remained stable (SLVWD, 2009).

2.1.3.d Seismic faults

The three seismic faults nearest to the site are the Ben Lomond Fault (1 mile west), the Zayante Fault (4 miles north), and the Butano Fault (7 miles northeast) (RTD, 2009).

2.1.3.e The Olympia wells

The District operates two wells on the property, Olympia Well 2 and Olympia Well 3, which supply the District's northern service area. The wells are operated primarily in the summer, when the District stops drawing from its surface water sources.

Olympia Well 2 is 310 feet deep with a 160-foot sanitary seal and 40 feet of open screen. Its static and pumping water levels average about 180 and 215 feet below ground surface, respectively. Under ideal conditions the well yields up to about 350 gallons per minute (Johnson, 2006).

Olympia Well 3 is also 310 feet deep with a 160-foot sanitary seal, but it has 70 feet of open screen. Its static and pumping water levels average about 190 and 220 feet below ground surface, respectively. Under ideal conditions the well yields up to about 340 gallons per minute (Johnson, 2006).

2.1.3.f Soils and underlying aquifers

Groundwater recharge to the Olympia wells is derived primarily from percolating rainfall. Soils are permeable, finer textured sands of the Zayante series, formed from marine sediments. The permeability of these soils is rapid, making them conducive to recharge of the Santa Margarita aquifer. Because these same Zayante soils are also specifically tied to the rare Sandhills habitat,

the soils of the Olympia Watershed property are critical to both water supply and biodiversity. In areas where native soils have been removed or buried by quarrying (RTD, 2009), the surface material has been mapped as the Pits-Dumps Complex. Figure 2-2 depicts the underlying aquifers and drainages on the property.

2.1.3.g Erosion and runoff

Gullies and drainage depressions, formed from historic site use disturbances have increased runoff. These disturbances include mining, equestrian and pedestrian trails, and off-road vehicle tracks. The erosion hazard is moderate to high, especially along non-vegetated trails, dirt roads and steep slopes remaining from mining operations. The erosion potential has been further elevated by recreational horseback riding (RTD, 2009).

2.1.3.h Native plant communities, sensitive species, and invasive species

The sandy Zayante soils in the lower elevation western half of the property, which were historically quarried to provide high quality fine sand for commercial purposes, also provide the substrate that supports extremely rare biotic communities, known as sand chaparral and sand parkland. For more information, see Section 2.3, Biotic Resources, as well as Part I: Existing Conditions Report. This community harbors mature Ponderosa pines, and six rare/endangered species that exist nowhere in the world outside of Santa Cruz County. These include the Zayante band-winged grasshopper, Mount Hermon June beetle, Ben Lomond spineflower, and Ben Lomond buckwheat. Of the 83 sandhills plants known to exist, 56 have been identified at the Olympia Watershed property (Schettler, 2011). For a complete list of these plants, see Table 2-3.

The loamy or finer textured soils on the steeply sloped eastern half of the property host dense, mixed conifer forests, including redwoods and Douglas firs. These native plant populations are impacted by many invasive exotic plant species, including silver wattle *(Acacia dealbata*), French broom (*Genista monspessulana)* and Portuguese broom (*Cytisus striatus*), eucalyptus sp or spp, and yellow-star thistle (*Centaurea solstitialis*).

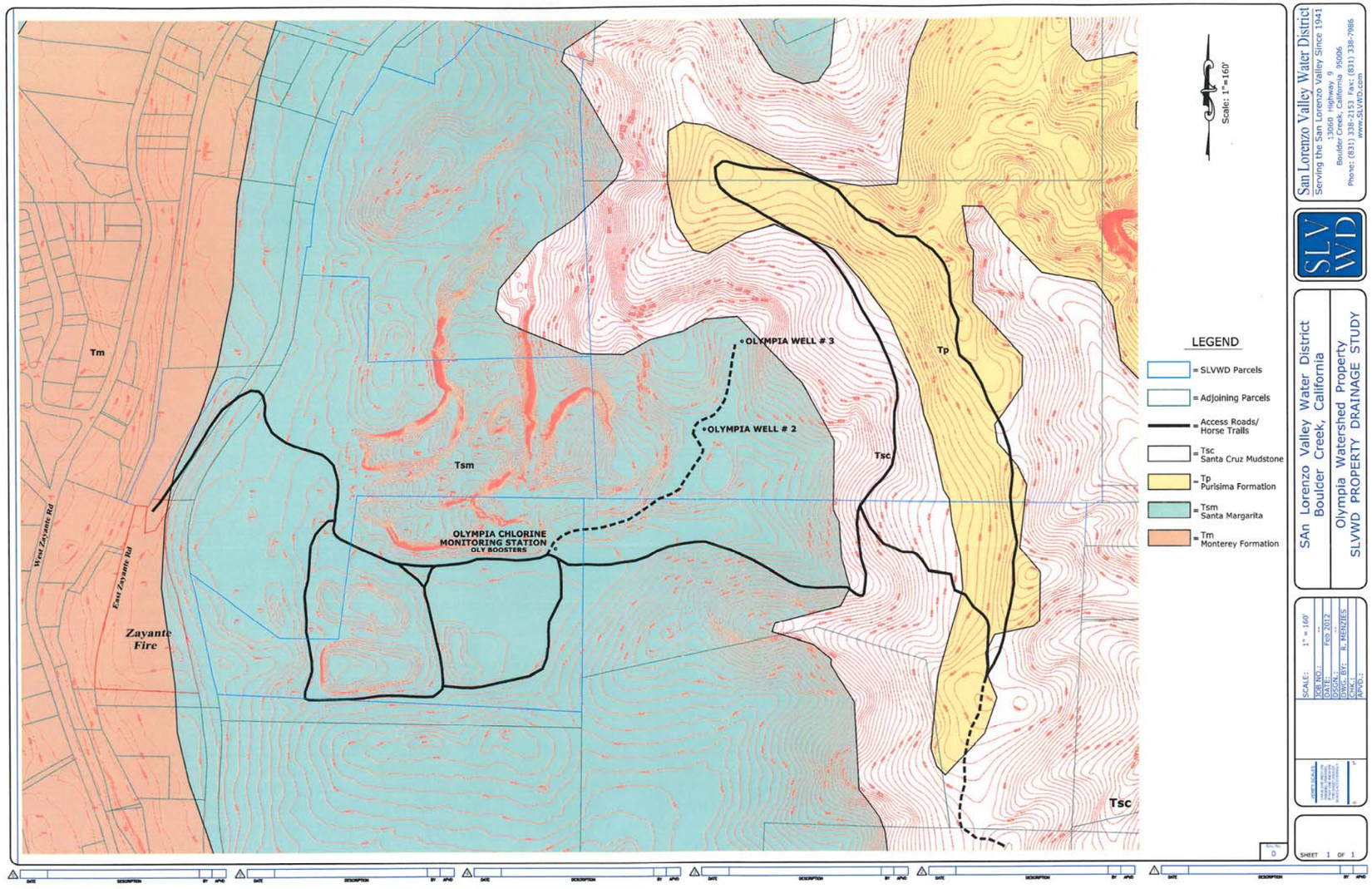
2.1.3.i Wildlife species observed and potentially present

The Olympia Watershed property is a haven for reptiles and amphibians, including rattlesnakes. Table 2.1 lists all of the reptiles and amphibians observed on the site by a local herpetologist (Mulks, personal communication, 2011).

Local high school science student Alex Rinkert (2011) has identified 83 species of birds at the Olympia Watershed property, as listed in Table 2.2.

Mammals observed on the property include the Santa Cruz kangaroo rat (*Dipodomys venustus venustus*), which was last identified in 1984 (McGraw, 2004). Mammals observed previously or determined to be potentially present at nearby Quail Hollow Quarry (Thomas Reid and Associates, 1997) include various bats, rodents, hares, rabbits, weasels, skunks, foxes, coyotes, deer, and possibly bobcats. Table 2.2.5 lists mammals potentially occurring at nearby Quail Hollow Quarry (LSA Associates, 1988).

Figure 2-2. Drainage areas and underlying aquifers of the Olympia Watershed property



The map above shows the Olympia Watershed property boundaries and District service roads overlain on a contour map to reveal drainages and riparian areas. One intermittent stream, known as Box Creek, flows along the southern boundary of the property and into Zayante Creek. Other unnamed intermittent creeks flow at the base of the steep forested slopes on the eastern half of the property. Colored areas represent the underlying aquifers on the property, as per the legend.

Table 2-1. Reptiles and amphibians observed at the Olympia Watershed property

Reptiles	Amphibians
Western fence lizard (*Sceloporus occidentalis*)	Arboreal salamander (*Aneides lugubris)*
Southern alligator lizard (*Elgaria multicarinatus*)	Yellow-eyed ensatina (*Ensatina eschscholtzii xanthoptica*)
Side-blotched lizard (*Uta stansburiana*) (Introduced species)	Pacific slender salamander (*Batrachoseps attenuatus*)
Sharp-tailed snake (*Contia tenui*s)	California newt (*Taricha torosa*)
Ring-necked snake (*Diadophis punctatus*)	Rough-skinned newt (*Taricha granulosa*)
Western yellow-bellied racer (*Coluber mormon*)	Pacific chorus frog (*Pseudacris regilla*)
Santa Cruz aquatic garter snake (*Thamnophis atratus*)	Red-legged frog (*Rana draytonii*)**
Terrestrial garter snake (*Thamnophis elegans*)	California toad (*Bufo boreas*)
Pacific gopher snake (*Pituophis catenifer catenifer*)	
Rubber boa (*Charina bottae*)	
California kingsnake (*Lampropeltis getula californiae*) (Released captive-bred desert snake; only one ever found on site)	
Coast mountain kingsnake (*Lampropeltis zonata multifasciata*)	
Northern Pacific rattlesnake (*Crotalus oreganus oreganus*)	
California striped racer (*Masticophis lateralis lateralis*)	

**listed as threatened under the U.S. Endangered Species Act *Source: Mitchell Mulks, 2011*

Table 2-2. Birds observed at the Olympia Watershed property from 11/01/10 – 7/31/11

Common name	Latin name	Common name	Latin name	Common name	Latin name
Mallard	*Anas platyrhynchos*	Hairy woodpecker	*Picoides villosus*	Wrentit	*Chamaea fasciata*
California quail	*Callipepla californica*	Northern flicker	*Colaptes auratus*	Hermit thrush	*Catharus guttatus*
Double-crested cormorant	*Phalacrocorax auritus*	Pacific-slope flycatcher	*Empidonax difficilis*	American robin	*Turdus migratorius*
Great blue heron	*Ardea herodias*	Black Phoebe	*Sayornis nigricans*	Varied thrush	*Ixoreus naevius*
Osprey	*Pandion haliaetus*	Hutton's vireo	*Vireo huttoni*	California thrasher	*Toxostoma redivivum*
Sharp-shinned hawk	*Accipiter striatus*	Warbling vireo	*Vireo gilvus*	European starling	*Sturnus vulgaris*
Cooper's hawk	*Accipiter cooperii*	Steller's jay	*Cyanocitta stelleri*	Cedar waxwing	*Bombycilla cedrorum*
Red-shouldered hawk	*Buteo lineatus*	Western scrub jay	*Aphelocoma californica californica*	Orange-crowned warbler	*Oreothlypis celata lutescens*
Red-tailed hawk	*Buteo jamaicensis*	American crow	*Corvus brachyrhynchos*	Yellow-rumped warbler	*Dendroica coronata*
American kestrel	*Falco sparverius*	Common raven	*Corvus corax*	Black-throated gray warbler	*Dendroica nigrescens*
Merlin	*Falco columbarius columbarius*	Northern rough-winged swallow	*Stelgidopteryx serripennis*	Townsend's warbler	*Dendroica townsendi*
Peregrine falcon	*Falco peregrinus*	Violet-green swallow	*Tachycineta thalassina*	Wilson's warbler	*Wilsonia pusilla*
Mew gull	*Larus canus*	Barn swallow	*Hirundo rustica*	Spotted towhee	*Pipilo maculatus*
California gull	*Larus californicus*	Cliff swallow	*Petrochelidon pyrrhonota*	California towhee	*Melozone crissalis*
Glaucous-winged gull	*Larus glaucescens*	Chestnut-backed chickadee	*Poecile rufescens*	Fox sparrow	*Passerella iliaca*
Band-tailed pigeon	*Patagioenas fasciata*	Oak titmouse	*Baeolophus inornatus*	Song sparrow	*Melospiza melodia*
Mourning dove	*Zenaida macroura*	Bushtit	*Psaltriparus minimus*	White-crowned sparrow	*Zonotrichia leucophrys pugetensis*
Anna's hummingbird	*Calypte anna*	Red-breasted nuthatch	*Sitta canadensis*	Golden-crowned sparrow	*Zonotrichia atricapilla*
Allen's hummingbird	*Selasphorus sasin*	Pygmy nuthatch	*Sitta pygmaea*	Dark-eyed junco	*Junco phaeonotus*
Acorn woodpecker	*Melanerpes formicivorus*	Brown creeper	*Certhia americana*	Black-headed Grosbeak	*Pheucticus melanocephalus*
Nuttall's	*Picoides*	Bewick's	*Thryomanes*	Red-winged	*Agelaius*

woodpecker	*nuttallii*	wren	*bewickii*	blackbird	*phoeniceus*
Red-shouldered hawk	*Buteo lineatus*	Pacific wren	*Troglodytes pacificus*	Brewer's blackbird	*Euphagus cyanocephalus*
Red-tailed hawk	*Buteo jamaicensis*	Golden-crowned Kinglet	*Regulus satrapa*	Purple finch	*Carpodacus purpureus*
American kestrel	*Falco sparverius*	Ruby-crowned kinglet	*Regulus calendula*	House finch	*Carpodacus mexicanus*
Pine siskin	*Carduelis pinus*	American goldfinch	*Carduelis tristis*	Lesser goldfinch	*Carduelis psaltria*
Vaux's swift	*Chaetura vauxi*	Belted kingfisher	*Ceryle alcyon*	Western Wood-Pewee	*Contopus sordidulus*
Pileated woodpecker	*Dryocopus pileatus*	Ash-throated Flycatcher	*Myiarchus cinerascens*	Swainson's Thrush	*Catharus ustulatus*
Olive-sided Flycatcher	*Contopus cooperi*	Brown-headed Cowbird	*Molothrus ater*		

Source: Alex Rinkert 2011

Table 2.2.5: Mammals potentially present at nearby Quail Hollow Quarry

Common name	Latin name	Common name	Latin name	Common name	Latin name
Virginia opossum	*Didelphis virginiana*	Vagrant shrew	*Sorex vagrans*	Trowbridge's shrew	*Sorex trowbridgii*
Shrew-mole	*Neurotrichus gibbsii*	Broad-footed mole	*Scapanus latimanus*	Little brown myotis	*Myotis lucifugus*
Long-eared myotis	*Myotis evotis*	Fringed myotis	*Mytois thysanodes*	Long-legged myotis	*Myotis volans*
California myotis	*Myotis californicus*	Big brown bat	*Eptesicus fuscus*	Red bat	*Lasiurus borealis*
Hoary bat	*Lasiurus cinereus*	Brazilian free-tailed bat	*Tadarida brasiliensis*	Brush rabbit	*Sylivlagus bachmani*
Desert cottontail	*Sylvilagus audobonii*	Black-tailed hare	*Lepus californicus*	Merriam's chipmunk	*Tamias merriami*
California ground squirrel	*Spermophilus beechevi*	Botta's pocket gopher	*Thomomys bottae*	California pocket mouse	*Perognathus californicus*
Santa Cruz kangaroo rat	*Dipodomys venustus*	Western harvest mouse	*Reithrodontomys megalotis*	California mouse	*Peromyscus californicus*
Deer mouse	*Peromyscus maniculatas*	Pinyon mouse	*Peromyscus truei*	Dusky-footed woodrat	*Neotoma fuscipes*
Coyote	*Canis latrans*	Grey fox	*Urocyon cineroargenteus*	Ringtail	*Bassariscus astutus*
Raccoon	*Procyon lotor*	Long-tailed weasel	*Mustela frenata*	Western spotted skunk	*Spilogale gracilis*
Striped skunk	*Mephitis mephitis*	Mountain lion	*Felis concolor*	House cat (feral)	*Fellis domestica*

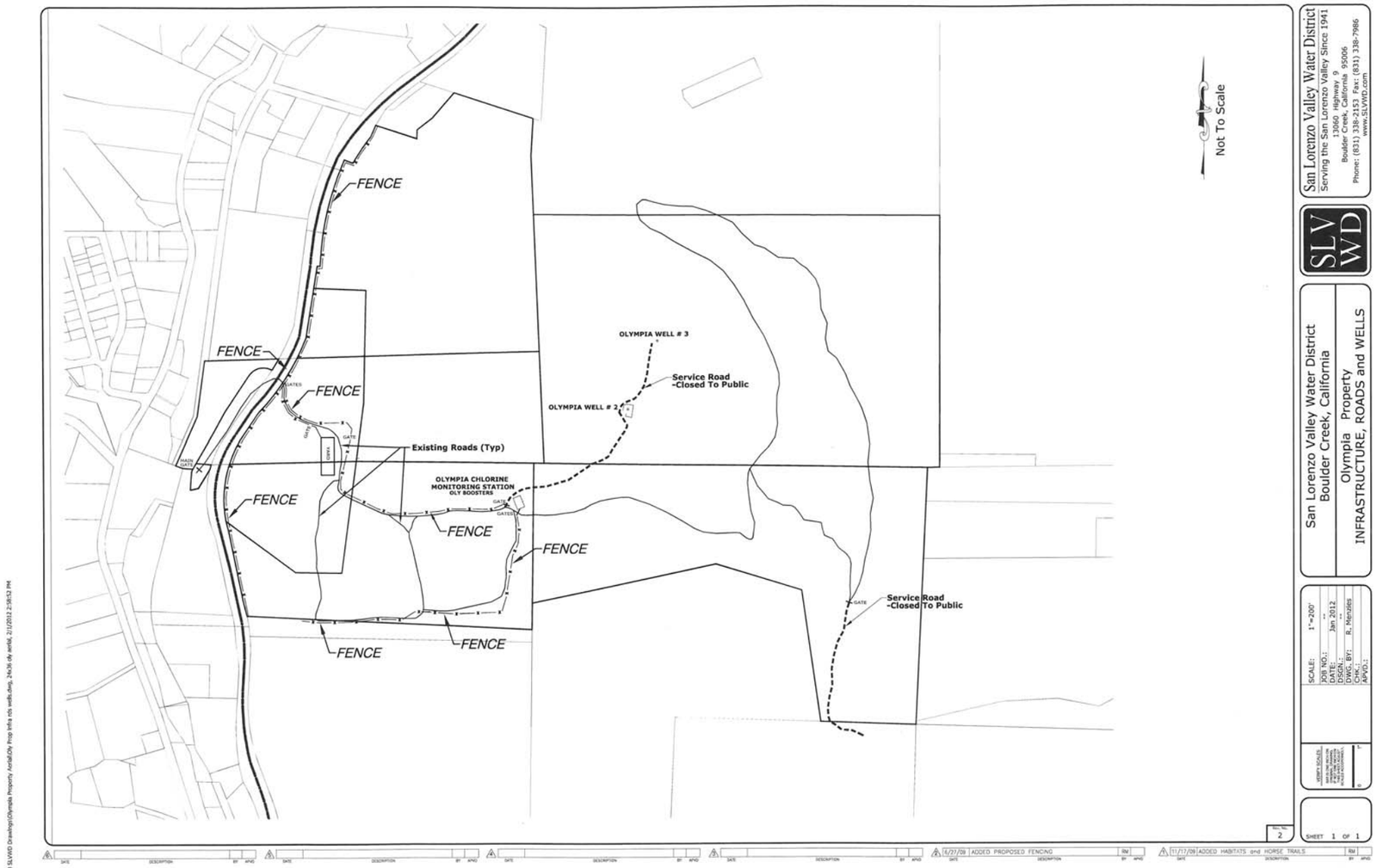
Source: LSA, 1988

2.1.3.j District wells, service and access roads

Figure 2-3 depicts District wells and pipelines in black, and District service and access roads in red. District service roads are used to provide staff vehicular access to maintain wells and pipelines. Roads on the northeast side are primarily used as fire access roads.

The fire access roads mentioned here are identified in the County Wide Community Wildfire Protection Plan (CWPP). There are additional roads not shown on the maps in this draft that extend to the east and north of the roads mapped. These other roads make the district section of roads critical in fire suppression access and control. I recommend that these other roads be added to the map to put the districts road in context. On the other hand there is a short linking road that is shown on the maps that could be abandoned. It crosses steep ground, was added sometime after the 1995 timber harvest and appears to be unnecessary to this road system and should be appropriately abandoned

Figure 2-3. Olympia Watershed site map showing District roads and other infrastructure



The map above shows Olympia Watershed parcel boundaries, utility yard, fencing, service and access roads and wells.

Comment [BH1]: Make roads red

2.2 Hydrology, geomorphology and water quality

In addition to meeting the primary goal of watershed management, all activities prescribed to address hydrology, geomorphology and water quality must also address the following secondary goals:

Secondary goal: *Consider climate change impacts and reduction of greenhouse gases in all watershed management decisions;*

Secondary goal: *Review and revise management decisions in response to changing conditions.*

2.2.1 Review of existing conditions: Hydrology, geomorphology and water quality

This section summarizes the existing conditions with regards to the hydrology, geomorphology, and water quality on the Olympia Watershed property, as documented in the District's Existing Conditions report (SLVWD, 2009), environmental site assessment findings (RTD, 2009), and the District's Water Supply Master Plan (SLVWD, 2008).

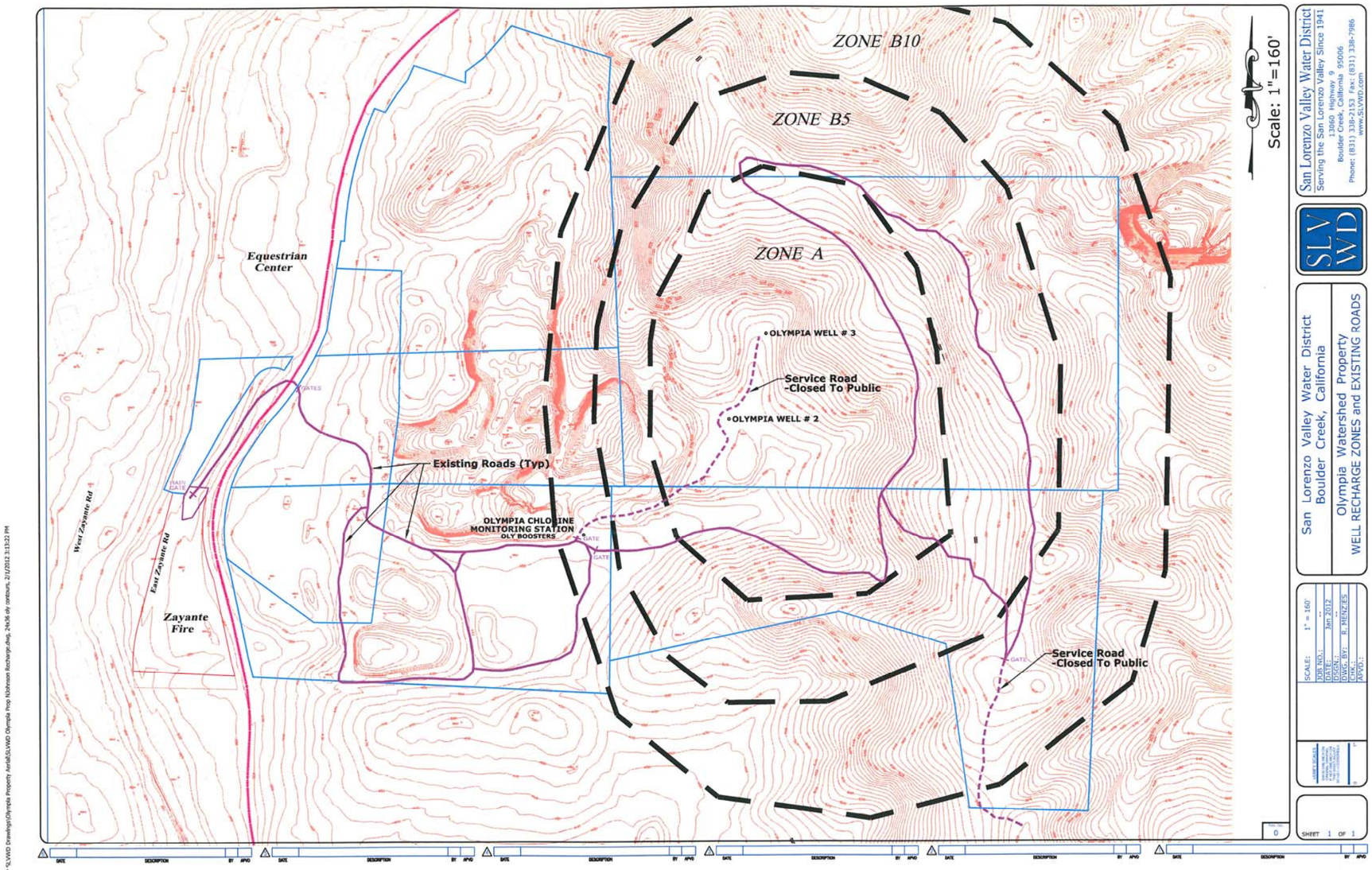
2.2.1.1 Groundwater recharge

The overall capture zone for the water supply tapped by the District's Olympia wells is approximately 1,200 acres. The Olympia Watershed property constitutes 180 acres of that recharge area. Groundwater recharge to the Olympia wells is derived primarily from percolating rainfall. Groundwater occurs under unconfined conditions in the Olympia area, even where the aquifer is overlain by mudstone. Because of the synclinal fold, the aquifer becomes unsaturated to the north and south and is not in direct hydraulic contact with either Bean Creek or upper Zayante Creek. The aquifer base also rises to the west where the sandstone has been mostly eroded away along Zayante Creek. As such, the aquifer is generally not in direct contact with the portion of Zayante Creek nearest to the wellfield, with the exception of an approximately 700-foot long stretch where a thin band of sandstone crosses the creek between the Olympia and Quail Hollow areas.

The recharge area for the Olympia wellfield is rural and undeveloped, and much of the aquifer lies beneath less permeable mudstone. An old sand pit immediately west of District wells serves as a stormwater retention basin that recharges the aquifer, and receives stormwater from a relatively undeveloped area. Where the aquifer is exposed to the surface, it has a high percolation capacity.

Figure 2-4 shows that the District service roads overlie the most vulnerable recharge zones to the District's production wells.

Figure 2-4. Olympia Watershed well recharge zones in relation to service and access roads



The contour map above depicts existing roads in purple and the recharge zones for the District's production wells in broken black lines. Parcel boundaries are shown in blue.

2.2.1.2 Riparian areas and drainages

Figure 2.2 is a map, compiled in-house from existing County contour maps and USGS topographic maps, depicting riparian and drainage areas on the property.

2.2.1.3. Potential sources of water pollution

The groundwater source tapped by the Olympia wells is relatively protected due to the rural and undeveloped nature of the recharge area. The sand pit immediately west of the Olympia wells serves as a stormwater retention basin, which receives stormwater from a relatively undeveloped area.

Factors contributing to the potential water-quality vulnerability of SLVWD Olympia well 2 include the undestroyed Olympia 2 test well located approximately 14 feet away, and the high percolation capacity of the Santa Margarita Sandstone where exposed at the ground surface. While the source water protection zone itself has little development, the buffer zone surrounding it contains many residences with septic tanks. This includes approximately 40 homes along East Zayante Road, 30 homes along Ryder Gulch and the eastern slopes of Lockhart Gulch, and 100 homes along Lockhart Gulch. The equestrian center is located at the western edge of the capture area, and the Olympia Watershed service roads are open to recreational riding. However, according to the 2006 Drinking Water Source Protection and Assessment Report, there is no evidence of any adverse water quality influence from septic tanks or horses. Potential fuel spills could be associated with active quarrying near the southwest fringe of the buffer zone.

The environmental site assessment conducted in 2009 identified several indications of likely historical hazardous material use on site, including dynamite (RTD, 2009).

2.2.1.4 Data gaps

Part I: Existing Conditions Report, Chapter 3: Hydrology, Geology, and Water Quality identified data gaps 1 and 2 below with regards to hydrology, geomorphology and water quality on District watershed lands. Data gap 3 below was identified since publication of Part I.

1. The District has not yet surveyed, mapped, and assessed the existing road system on its watershed land holdings.
2. The District has not yet mapped sites of toxics or hazardous wastes, dangerous cliffs, erosion prone soils, mine shafts, pipeline and overhead power line corridors, etc. that might limit management actions and access.
3. The District has not assessed the potential impacts of groundwater pumping at the Olympia Watershed property on creeks downstream of the property.

Since publication of Part I: Existing Conditions Report in 2009, the District has mapped the road and trail system at the Olympia Watershed property (Figures 2-1, 2-3 and 2-4), and has partially completed mapping of the components in the second data gap (Figure 2-7).

Data gaps that apply to the Olympia Watershed property are further discussed below in paragraphs 2.2.2 – 2.2.5.

2.2.2 Key issues with respect to hydrology, geomorphology, and water quality

In consideration of Part II: Goals, Objectives and Policies, and the findings of Part I: Existing Conditions Report, the key issues on the Olympia Watershed property related to hydrology, water quality, and geology are:

- Old quarrying equipment and debris are scattered throughout the site;
- More information is needed to assess conditions and potential impacts of old quarry excavation and settling ponds;
- Roads and trails are placed in geologically unstable areas, which could increase the risk of erosion;
- Trespass from off-road vehicles, mountain bikes and equestrian use throughout the property have compacted soils, increased erosion and potentially impacted water quality.
- Groundwater pumping on the Olympia Watershed property may affect creeks downstream
- Potential sources of water quality impacts to District wells include nitrates from neighboring septic systems, pathogens and nitrates from adjacent stables and equestrian use on service roads.

2.2.3 Hydro opportunities & constraints

Opportunities:

- Documentation of Olympia Watershed property provides a major opportunity to interpret the site as a watershed and water supply asset;
- Erosion prone soils, especially in the excavated sand pit, could be mapped and assessed in terms of suitability for management access;
- Mining debris and old structures left over from past quarrying activity can be removed to evaluate potential impacts from chemicals of concern (RTD, 2009);
- Many existing horse and illegal motorcycle trails can be eliminated to reduce trespass, erosion and water quality impact;
- The potential for erosion resulting from roads and trails can be reduced through consideration of geologic factors and application of best management practices;
- Restoration and enhancement of native plant communities would enhance geomorphic stability and physical habitat;
- Recent clean-up and redesign of the utility yard along the service road, and revamping of the District's temporary debris storage program will reduce potential impacts to water quality;
- Grant funding may be available from California Department of Fish and Game's salmonid program to hire a consulting firm to assess the road network, identify sediment sources, and estimate sediment savings through implementation of BMP projects.

Constraints:

- Some roads must remain in order to enable servicing of wells and pipelines and for fire access;
- Removal of exotic vegetation may destabilize soils along roads and trails;
- Removal of mining debris could impact habitat of the Mt. Hermon June beetle.

2.2.3.1 Alternatives for addressing mapping and assessing areas of erosion prone soils

The Existing Conditions report identified a data gap with respect to mapping of sites of erosion-prone soils that might limit management actions and access. Alternatives identified for addressing this data gap on the Olympia Watershed property include:

Alternative 1: Map and assess the erosion prone soils in terms of management limitations and access;

Alternative 2: Map and assess erosion prone areas on a project-by-project basis, as management actions and access are considered;

Alternative 3: Combine elements of Alternative 1 and 2 to identify and map known areas of erosion prone soils, and perform a more thorough analysis on a project-by-project basis.

Discussion

Alternative 1 would provide early information, but since conditions could change before any management projects were proposed in erosion-prone areas, additional assessment could be required later, duplicating costs. On the other hand, mapping prior to individual project proposals would assure that preliminary siting of future projects could consider known erosion hazard.

Alternative 2 would allow mapping and assessment of specific areas of erosion prone soils as projects were proposed; would not duplicate costs.

Alternative 3 combines Alternative 1 and Alternative 2 and is the recommended alternative to best meet the goals of water quality protection and enhancement of natural resources. Known erosion prone areas should be mapped in the near future, and more specific assessment should be done as part of individual project design. As a public agency, the District complies with CEQA and conducts the appropriate assessments prior to undertaking any project with potential to impact the environment.

2.2.3.2 Recommended measure for mapping and assessing erosion prone soils

The following measure, HYDRO-1, is recommended to implement Alternative 3:

HYDRO-1: Map and assess known areas of erosion prone soils, and more specifically assess erosion-prone soils on a project-by-project basis

Hydro-1 Description

Map all known areas of erosion prone soils on the property. Prior to initiating any management project, more specifically map and assess erosion prone soils to determine the suitability of the area for the proposed project.

HYDRO-1 should be accomplished under the following program:

1) Map known areas of erosion-prone soils;

2) Before management activities or access is considered, include a site assessment of erosion-prone soils.

Hydro-1 Cost

Initial mapping estimated at $2,500. Further costs to be determined by project.

Hydro-1 Future Conditions

Inappropriate projects would be avoided in areas of erosive soils.

Hydro-1 Monitoring

To be determined by project.

2.2.3.3 Road and trail management alternatives

District service and fire access roads on the Olympia Watershed property have been mapped and are routinely maintained and repaired. Figure 2-4 shows that the District service roads overlay the most vulnerable recharge zones to the District's production wells. Because the fire access road is located on extremely steep terrain, it is routinely closed to vehicular access during the wet months. A network of illegal dirt bike and horse trails exist throughout the property, and some have become seriously channelized. These trails have been partially mapped. Alternatives identified for road/trail management are the following:

Alternative 1: Remove all road/trail-related sediment sources (i.e. those showing evidence of erosion) through closure, stabilization or "putting to bed," and eliminate all access to these areas;

Alternative 2: Remove all roads/trails, regardless of their condition, and eliminate all road/trail access;

Alternative 3: Minimize road/trail related sediment sources, prohibit use of roads by motorized vehicles unless necessary to maintain District facilities, and stabilize a set of roads/trails deemed essential to provide restricted access for maintenance of District infrastructure, access for fire fighting, and access for environmental enhancement work;

Alternative 4: Leave all roads/trails as they currently exist and discontinue maintenance;

Alternative 5: Continue maintenance of existing roads/trails per existing program.

Discussion

Alternative 1 would accomplish the objective of removing all sediment sources, but would prevent fire access and access to environmental enhancement work.

Alternative 2 would prevent the District from servicing its infrastructure, eliminate access for environmental enhancement and fire management.

Alternative 3 would minimize sediment, while allowing fire access and access to environmental enhancement work. By prohibiting heavy vehicles on District roads, except if necessary to maintain or protect District facilities, Alternative 3 would minimize future compaction to the roads and protect recharge areas below.

Alternative 4 would leave roads and trails unmaintained, counter to water quality objectives, and would create considerable risks.

Alternative 5 would continue the current road maintenance program, but would not address the impacts to water quality from leaving illegal trails unmaintained and unrepaired.

Of these alternatives, Alternative 3 best meets the District's primary goals of protecting water quality and supply, as well as secondary goals of providing restricted access for recreational uses and fire fighting.

2.2.3.4 Recommended road and trail management measures

The following measure, HYDRO-2, is recommended to implement the preferred Alternative 3:

HYDRO-2: Reduce risk of erosion, pollution, and compaction from roads/trails

Hydro-2 Description

The access road on the steep eastern portion of the Olympia Watershed property should be assessed for erosion problems and stabilized to eliminate any evidence of erosion from road surfaces, cuts, and shoulders and to minimize the disruption of natural hillslope drainage. Recreational use should remain limited to approved sections of District service roads to reduce water quality and supply impacts within the most vulnerable recharge zones. The location and specifications for erosion control practices should be planned or reviewed by a certified professional in erosion and sediment control, due to the difficulty of establishing effective erosion control on sandy soils.

HYDRO-2 and the elimination of road/trail impacts should be accomplished under the following program:

1) The existing road/trail system should be assessed to establish baseline erosion conditions;

2) The access road and old, unauthorized recreation trails should be stabilized such that erosion rates are no greater than low background rates (i.e. no visible evidence of erosion), and so that drainage patterns are as natural as possible without concentrating runoff;

3) Access to all old recreational trails should remain blocked, and signs remain posted accordingly;

4) To reduce the risk of contamination by gasoline spills, prohibit use of District service roads located in vulnerable recharge areas by motorized vehicles, except if necessary to protect or maintain District facilities;

5) To the extent feasible, avoid motorized vehicle use when soils are wet and use tracked vehicles or lighter-weight vehicles to reduce road destabilization.

Hydro-2 Cost

The District currently maintains its service roads annually before closing down the steep uplands road for the winter. Water bars are upgraded, brush is cleared, and gates to the steep upland area are closed and locked. The cost of the current road maintenance program is approximately $3,500 per year. Prohibiting heavy vehicles from using the service roads is a cost-effective way to preclude more expensive road stabilization engineering projects in the future. The cost of individual trail stabilization will vary depending upon the terrain. The District fenced off sensitive areas in 2011, so many unauthorized trails are already blocked. Some trails in unstable steep slopes might best be left in a state of permanent closure, with only drainage improvements to minimize soil loss.

Hydro-2 Future Conditions

Protecting the stability of roads/trails should have a positive impact on water quality and supply, since unstable roads are subject to erosion, which could impact water quality. Blocking/removing unnecessary roads and trails should reduce trespass from motorized vehicles, as well as carbon emissions.

Hydro-2 Monitoring

The success of the road/trail improvement program would be determined by its ability to reduce erosion rates to background levels. A road/trail survey would serve as a baseline. Background levels of erosion are indicated by hillslope surfaces that have established humus, duff and/or leaf litter overlying mineral soil. Exposed soil or subsoil should not exhibit any evidence of sheet, rill or gully erosion. Monitoring involves annual surveys along former and retained road alignments after each winter to assess the changes in erosion after roads/trails are removed and/or stabilized.

Retained service/fire roads and trails should be inspected following any significant earthquake for damage that would compromise existing drainage systems in a way that could contribute to soil erosion. All observed damage should be ranked according to hazard potential and scheduled for repair, in order of priority, as expeditiously as possible.

2.2.3.5 Removal of old quarrying debris management alternatives

Old quarrying equipment and metal debris is scattered throughout the western half of the property, much of it buried or partly visible in the sandy soils. Debris consists of old structures, rusting cable, and metal scrap (Figure 2-7). RTD (2009) recommends surveying the site to locate all abandoned sites and equipment, dismantling and removing it, in order to assess the site for potential contamination. The District removed several old metal structures during its invasive exotic species removal project in 2009-2010. More debris was uncovered as a result of this vegetation removal, as predicted by RTD.

Alternatives identified for removing old mining debris are the following:

Alternative 1: Survey and record the locations of all site structures and abandoned quarry equipment; dismantle and remove old site structures and abandoned equipment, sample and analyze soils for contamination;

Alternative 2: Leave the site as it is.

Discussion

Alternative 1 is recommended by the consultants who completed the environmental site assessment, and would best satisfy the primary and secondary goals of the watershed management plan. Removing debris would have a long-term positive impact on the species, by creating additional habitat for all aspects of the species' life history. While the act of removing the debris will cause a temporary short-term impact, and "take" that should be addressed through proper permitting, these short-term impacts will be outweighed by the long-term benefits of restoring habitat.

Moreover, the act of removing mining debris is quite likely to cause impacts to more than just the Mount Hermon June beetle. Ben Lomond spineflower, Ben Lomond buckwheat, and other

rare species, as well as the special status community as a whole, will be disturbed. As with Mount Hermon June beetle, the long-term benefits of removing the debris will in most cases outweigh the short-term impacts, particularly if those impacts are appropriately mitigated.

Before removing old mining equipment, pieces should be assessed for possible historical value (see 6.1.2 Historical Resources). Alternative 2 would not satisfy the primary goal of the watershed management plan, but would possibly reduce impacts to the endangered Mt. Hermon June beetle, whose nesting sites underground would likely be disturbed by old debris removal.

Of these alternatives, only Alternative 1 meets the primary goal of the watershed management plan. Care would have to be taken to mitigate any impacts to the Mt. Hermon June beetle habitat.

2.2.3.6 Removal of old quarrying debris recommended measures

The following measure, HYDRO-3, is recommended to implement the preferred Alternative 1:

HYDRO-3: Locate and remove old quarrying debris, and test soils beneath for potential contamination

Hydro-3 Description

The District should accurately record the location of all site structures and abandoned quarry equipment. Debris should be prioritized for removal. Once debris has been removed, the site should be assessed for chemical contamination. Debris removal is likely to increase the surface area available for colonization by sandhills plants, which are characteristically early-succession species (Schettler, 2012).

HYDRO-3 and the removal of old quarrying debris should be accomplished under the following program:

1) Accurately record the location of all site structures and abandoned quarry equipment, possibly using LIDAR;
2) Map using in-house GIS the location of these sites;
3) Consult with endangered species experts to establish mitigations to reduce the impacts on endangered species from debris removal;
4) Determine if equipment has historical significance;
5) Prioritize areas for debris removal;
6) Remove debris over time;
7) Assess soils at removal sites for potential chemical contamination;
8) Treat any contaminated areas to address any water quality issues.

Hydro-3 Cost

The cost of surveying for old mining debris could be significant. The project would likely require a formal request for proposal to determine the costs.

Hydro-3 Future Conditions

The removal of old mining debris may have a positive impact on water quality and supply, if any sites are found to be contaminated, and then treated.

Hydro-3 Monitoring

Records should be kept of all removed equipment and structures and soil sample results.

2.2.3.7 Debris storage management program

The District uses the area immediately adjacent to, and on the south side of the service entrance road as a temporary storage area for debris from District operations and maintenance activities. District service vehicles truck in this debris from other parts of the District service area.

In 2011, the District redesigned its debris storage management program to conform to District goals and policies. The District Board approved a resolution on September 1, 2011 to expand the utility yard area to accommodate temporary storage and de-watering of trench line spoils and construction debris, to secure the utility yard with chain-link fencing and gates to prevent vandalism and scavenging, and to post both interpretive and restrictive signs on the fence.

The District now stockpiles asphalt on existing concrete pads within the utility yard. To avoid potential impacts to sensitive species on the Olympia Watershed property from invasive seed, vegetation collected throughout the District service area is now stored at the District's Lyon tank site. Ash from illegal fires in and near the utility yard was cleaned up to prevent leaching into the water table.

Black rubber tarps, once historically used to line and cover "Big Con" water reservoir, were later removed and deposited on the ground by the District in several areas of the Olympia Watershed property. The tarps were unsightly and harbored various reptiles, including rattle snakes (see further discussion of the biological impacts of the tarps in the Biotic Resources section of this chapter). The District was advised by a local herpetologist to remove the tarps as soon as possible, since they are known to attract poachers of reptiles. After consultations with the US Fish and Wildlife Service, the District removed the tarps with a backhoe, while a local herpetologist captured and relocated many reptiles and amphibians that were using the tarps as habitat. The tarps were temporarily stored in the utility yard, until they can be recycled.

Three types of materials are now temporarily stored in the utility yard:

1) Pieces of asphalt, concrete, pipes, and other construction debris are stockpiled on concrete pads and thereafter periodically transferred to the appropriate recycling or disposal area.

2) The District maintains a large dumpster for collection and disposal of miscellaneous operational debris. The District contracts with a service to remove, as needed, and properly dispose of the contents. Before it was fenced off, the dumpster had frequently been scavenged by trespassers, and its contents spread about the property.

3) The District stores trench line spoils in designated areas for de-watering. These spoils consist of soil, sand, gravel and backfill materials, generated from the servicing of main breaks throughout the District service area. Emergency main breaks often require the District to move trench line spoils outside of regular business hours when landfills are open.

Temporarily storing trench line spoils on site gives them time to dry, thus greatly reducing their weight and allowing them to be more economically transferred to a local landfill, as required by law. In addition to hydrologic benefits, continued clean-up of the property eliminates attractive nuisances, increases public safety, and enhances the aesthetic and recreational experience.

2.2.3.8 Temporary debris storage management alternatives

The current temporary debris storage program addresses the primary concerns identified by Part I: Existing Conditions Report, reduction in the volume of trench-line spoils stored on site would further reduce potential impacts to water quality.

Alternatives identified to address the volume of trench-line spoils stored on site include:

Alternative 1: Reduce volume of trench-line spoils and construction debris stored on site by adhering to best management practices during construction activities that produce the spoils;

Alternative 2: Accept current volume of trench-line spoils stored on site as necessary.

Discussion

Alternative 1 is a reasonable approach. During main-break repair and other trenching activities by District, staff could more carefully follow best management practices with the aim of reducing the volume of trench-line spoils that need to be transported to the Olympia Watershed site for temporary storage. Monitoring of the volume stored over time could determine the success of these efforts.

2.2.3.9 Temporary debris storage recommended measures

HYDRO-4: Reduce volume of trench-line spoils and construction debris stored on site

The District should reduce the volume of trench-line spoils stored on site using the following steps:

1. Implement best management practices to reduce the volume of trench-line spoils;
2. Monitor volumes of trench line spoils and construction debris stored on site.

HYDRO-4 Costs

Some staff time would be needed to assess best management practices and apply to relevant construction activities. Potential cost savings could result if a lower volume of trench-line spoils were produced, because transporting spoils is expensive.

HYDRO-4 Future conditions

Better adherence to best management practices would likely reduce the volume of materials stored at the Olympia site, and could further reduce potential impacts to water quality.

HYDRO-4 Monitoring

The District has implemented a spoils log which documents the date, type, volume, and location of trench line spoils and construction debris offloaded by District employees. The District could use this information to track the volume of spoils disposal and construction debris storage at the Olympia Watershed site.

2.3 Biotic resources

In addition to meeting the District's primary goal for watershed management, all management activities prescribed to protect biotic resources must also meet the following secondary goals:

Secondary goal: *Consider climate change impacts and reduction of greenhouse gases in all watershed management decisions;*

Secondary goal: *Review and revise management decisions in response to changing conditions.*

2.3.1 Review of existing conditions: Biotic resources

The following subsections describe existing conditions in sand chaparral, sand parkland, upland mixed forest and riparian areas of the Olympia Watershed property.

2.3.1.1 Sand chaparral and sand parkland communities

Two rare biotic communities have been documented on the Olympia Watershed property, *sand chaparral* and *sand parkland* (Harvey & Stanley Associates, Inc., 1983; McGraw, 2004; Schettler, 2011).

2.3.1.1.1 Vegetation of sand chaparral and sand parkland

Sand chaparral is dominated by shrubs including buck brush (*Ceanothus cuneatus* var. *cuneatus)*, and silverleaf manzanita (*Arctostaphylos silvicola*), which is endemic to the sandhills. Sand chaparral also contains scattered trees, including short-statured coast live oaks and two species of pine: knobcone (*Pinus attenuata*) and ponderosa (*Pinus ponderosa*). Within the gaps in the shrub and tree canopy, sand chaparral usually supports numerous herbaceous plants, including the following, which are found on the Olympia Watershed property: several species of navarettia, Santa Cruz monkeyflower (*Mimulus rattanni ssp. l*), and the Ben Lomond spineflower (*Chorizanthe pungens var. hartwegiana*), which is also endemic to the sandhills.

Sand parkland is an extraordinarily rare community, occurring on fewer than 200 acres in the world (McGraw, 2004). Sand parkland is characterized by a sparse canopy of ponderosa pines surrounded by a diverse assemblage of subshrubs and herbaceous plants. Sand parkland contains the highest diversity and abundance of rare and unique herbaceous plant species, including the three endemic to the sandhills: the Ben Lomond spineflower (*Chorizanthe pungens ssp. hartwegiana*), Santa Cruz wallflower (*Erysimum teretifolium*), and Ben Lomond buckwheat (*Eriogonum nudum var. decurrens*) (McGraw, 2004).

2.3.1.1.2 Animals of the sand chaparral and sand parkland communities

For a more complete list of birds, mammals, reptiles and amphibians of the Olympia Watershed, please refer to the site description at the beginning of the chapter. This section describes the rare animal species associated with sand parkland communities including the Mount Hermon June beetle, the Zayante band-winged grasshopper (which are present at the Olympia Watershed) and the Santa Cruz kangaroo rat (which has not been observed there since 1984).

The Zayante band-winged grasshopper is an extremely rare species, found only in open habitat characteristic of sand parkland within the Santa Cruz Sandhills. The species was listed as federally endangered in 1997. During warm to hot days between May and September, this well-camouflaged grasshopper can be found basking or feeding on plants. At the hottest times of the day, they will take refuge in small shrubs, such as the silver bush lupine, scattered within sand parkland (McGraw, 2004).

The Mount Hermon June beetle (*Polyphylla barbata*) is found only in the Santa Cruz Sandhills, where it inhabits both the sand parkland and sand chaparral communities. The species is also

listed as federally endangered. It spends the first two years of its life underground as a larva, feeding on the roots of plants. Adults emerge from the sandy soil solely to mate. Only the males fly, searching for mates at twilight during the summer, between May and September.

The sandy areas of the Olympia Watershed property harbor prolific populations of native reptiles, including the Northern Pacific rattlesnake (*Crotalus oreganus oreganus*) and the California mountain kingsnake (*Lampropeltis zonata*).

2.3.1.2 Sand specialty plant species observed and mapped at Olympia Watershed in 2011

Local botanist Suzanne Schettler was awarded an Education Grant by the District in 2011 to identify and map rare plants of the sandhills communities (sand specialty plants) at the Olympia Watershed property. This project was aimed at filling a data gap identified in 2009 by the District's Watershed Management Plan, Part I: Existing Conditions Report. At that time, some of the rarest sand specialty plants had been identified on the property, but no survey or mapping had been completed.

Schettler identified and mapped 56 of the 83 plants associated with the sandhills at the Olympia Watershed property. The general locations of sand specialty plants are shown in Figure 2-5. More detailed maps are available for scientific research with permission of the District. Table 2-3 lists all known sand specialty plants, and indicates which were identified on the property.

Figure 2-5. General location of sand specialty plants at the Olympia Watershed

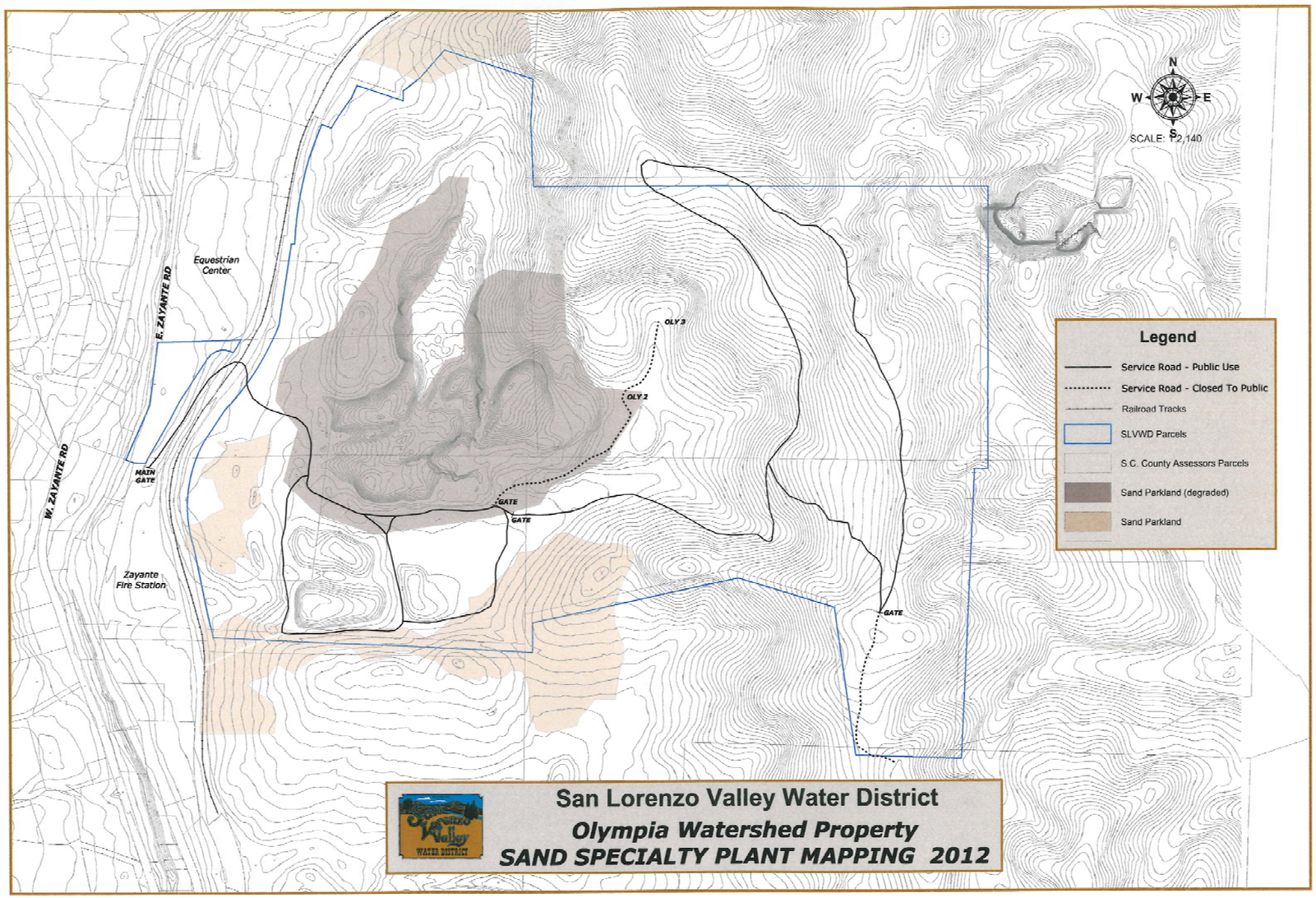


Table 2-3. Sand specialty plants of the Olympia Watershed

MORGAN 1983	JEPSON 1993	JEPSON 2011	COMMON NAME	Present at Olympia Watershed
Achillea borealis	*Achillea millefolium*		Yarrow	x
Antirrhinum multiflorum			Sticky Snapdragon	x
Arctostaphylos silvicola			Silverleaf Manzanita	x
Arenaria californica	*Minuartia californica*		Douglas' Sandwort	x
Arenaria douglasii	*Minuartia douglasii*		California Sandwort	x
Armeria maritima			Sea Thrift	
Artemisia pycnocephala (sand ecotype)			Beach Sagewort	
Brodiaea pulchella	*Dichelostemma capitatum*		Blue Dicks	x
Calochortus venustus (extinct?)			Mariposa	
Calyptridium umbellatum		*Calyptridium monospermum*	Pussy-paws	x
Cardionema ramosissimum			Sand-mat	x
Carex globosa			Round-fruited Sedge	x
Castilleja affinis			Indian Paintbrush	
Ceanothus cuneatus var. *dubius*	*Ceanothus cuneatus*		Buck Brush	x
Chorizanthe diffusa				x
Chorizanthe pungens var. *hartwegiana*			Ben Lomond Spineflower	x
Chrysopsis villosa var. *camphorata*	*Heterotheca sessiliflora* ssp. *echioides*		Golden Aster	x
Clarkia purpurea			Purple Clarkia	x
Clarkia rubicunda			Ruby Chalice Clarkia	
Clarkia unguiculata			Elegant Clarkia	x
Collinsia barstiaefolia var. *hirsuta*			White Chinese Houses	x
Corethrogyne filaginifolia var. *virgata*	*Lessingia filaginifolia*	*Corethrogyne filaginifolia*		x
Cryptantha hispidissima	*Cryptantha clevelandii*	*Cryptantha clevelandii* var. *florosa*	Cleveland's Cryptantha	x
Cryptantha micromeres			Minute-flowered Cryptantha	
Cryptantha muricata var. *jonesii*	*Cryptantha muricata*		Prickly Cryptantha	
Cupressus abramsiana		*Hesperocyparis abramsiana* var. *abramsiana*	Santa Cruz Cypress	
Delphinium parryi ssp. *seditosum*			Parry's Larkspur	x
Dudleya cymosa (sand ecotype)	*Dudleya palmeri*			
Eriogonum nudum var. decurrens			Tibinagua	x
Eriophyllum confertiflorum			Yellow Yarrow	x

Table 2-3. Sand specialty plants of the Olympia Watershed *(continued)*

MORGAN 1983	JEPSON 1993	JEPSON 2011	COMMON NAME	Present at Olympia Watershed
Erysimum teretifolium			Ben Lomond Wallflower	x
Eschscholzia californica (sand ecotype)			California Poppy	x
*Festuca confusa**	*Vulpia microstachys* var. *confusa*	*Festuca microstachys*	Hairy-leaved Fescue	
Festuca octoflora		*Festuca octoflora*	Slender Fescue	
Festuca octoflora var. *hirtella*	*Vulpia octoflora* var. *hirtella*	*Festuca octoflora*	Slender Fescue	
*Festuca pacifica**	*Vulpia microstachys* var. *pauciflora*	*Festuca microstachys*	Pacific Fescue	x
Festuca rubra			Red Fescue	
Filago californica		*Logfia californica*	California Filago	x
Gilia tenuiflora				x
Gnaphalium "Zayanteense" (proposed name)		*Pseudognaphalium "Zayanteense"*	Sandhills Everlasting	x
Gnaphalium beneolens	*Gnaphalium canescens* ssp. *beneolens*	*Pseudognaphalium beneolens*	Fragrant Everlasting	x
Haplopappus ericoides ssp. *blakei*	*Ericameria ericoides*		Mock Heather	x
Helianthemum scoparium			Rush-Rose	x
Hesperomecon linearis	*Meconella linearis*	*Hesperomecon linearis*	Narrow-leaved Meconella	
Horkelia cuneata	*Horkelia cuneata* ssp. *cuneata*	*Horkelia cuneata* var. *cuneata*	Wedge-leaved Horkelia	
Koeleria cristata	*Koeleria macrantha*		June Grass	x
Lasthenia chrysostoma	*Lasthenia californica* ssp. *californica*		Goldfields	x
Layia platyglossa (sand ecotype)			Tidy-Tips	x
Linanthus parviflorus (sand ecotype)		*Leptosiphon parviflorus*	Small-flowered Linanthus	x
Linaria texana	*Linaria canadensis* var. *texana*	*Nuttallanthus texanus*	Toadflax	x
Lotus scoparius	*Lotus scoparius* var. *scoparius*	*Acmispon glaber* var. *glaber*	Deerweed	x
Lotus strigosus		*Acmispon strigosus*	Deerweed	x
Lupinus albifrons			Silver Bush Lupine	x
Lupinus arboreus			Yellow Bush Lupine	x
Lupinus bicolor ssp. *umbellatus*			Lindley's Annual Lupine	x
Luzula multiflora	*Luzula comosa*	*Luzula comosa* var. *comosa*	Wood Rush	x

Table 2-3. Sand specialty plants of the Olympia Watershed *(continued)*

MORGAN 1983	JEPSON 1993	JEPSON 2011	COMMON NAME	Present at Olympia Watershed
Malacothrix clevelandii			Cleveland's Malacothrix	
Malacothrix floccifera			Wooly Dandelion	x
Mimulus androsaceus				
Mimulus rattanii var. *decurtatus*			Rattan's Monkeyflower	
Monardella undulata	*Monardella undulata* ssp. *undulata*		Wavy-leaved Monardella	x
Muilla maritima			Common Muilla	
Navarretia atractyloides				x
Oenothera contorta strigulosa	*Camissonia contorta*		Contorted Primrose	x
Oenothera micrantha	*Camissonia micrantha*	*Camissoniopsis micrantha*	Small Primrose	x
Orthocarpus purpurascens	*Castilleja exserta*		Owl's Clover	x
Pectocarya penicillata			Winged Pectocarya	
Pellaea mucronata			Bird's Foot Fern	
Phacelia distans			Common Phacelia	x
Phacelia douglasii			Douglas' Phacelia	
Pinus ponderosa			Yellow Pine	x
Pinus sabiniana			Digger Pine, Grey Pine	
Plagiobothrys tenellus			Slender Popcorn Flower	
Plantago erecta			California Plantain	x
Poa scabrella			Pine Bluegrass	
Salvia mellifera			Black Sage	x
Saxifraga californica		*Micranthes californica*	California Saxifrage	x
Scutellaria tuberosa			Skullcap	
Silene verecunda ssp. *platyota*		*Silene verecunda*	San Francisco Campion	
Stephanomeria virgata			Tall Stephanomeria	x
Thysanocarpus curvipes			Fringe-Pod	x
Tillaea erecta	*Crassula connata*		Pygmyweed	x

* *Festuca confusa* and *F. pacifica* have been consolidated into *Festuca microstachys* *(Schettler, 2011)*

2.3.1.3 Impacts to sandhills plants at Olympia Watershed

Most losses of sand chaparral and sand parkland have occurred due to open pit mining (before the District acquired these lands). The old Kaiser sand quarry on the Olympia watershed land was closed before the California Surface Mining and Reclamation Act of 1975 was in effect, so that no reclamation was done.

Due to the erosive nature of the Zayante soils, sand chaparral and sand parkland communities are extremely susceptible to disturbances, including that from off-road vehicles and horseback riding. These activities occur on the District-owned lands.

Invasive plant species such as French broom and acacia are well-established on the District-owned Olympia watershed lands, where they compete with endangered species for limited habitat. The District has actively engaged since 2008 in projects to control them. Figure 2-6 is a map showing the location of various invasive species, and the progress made to date in controlling them.

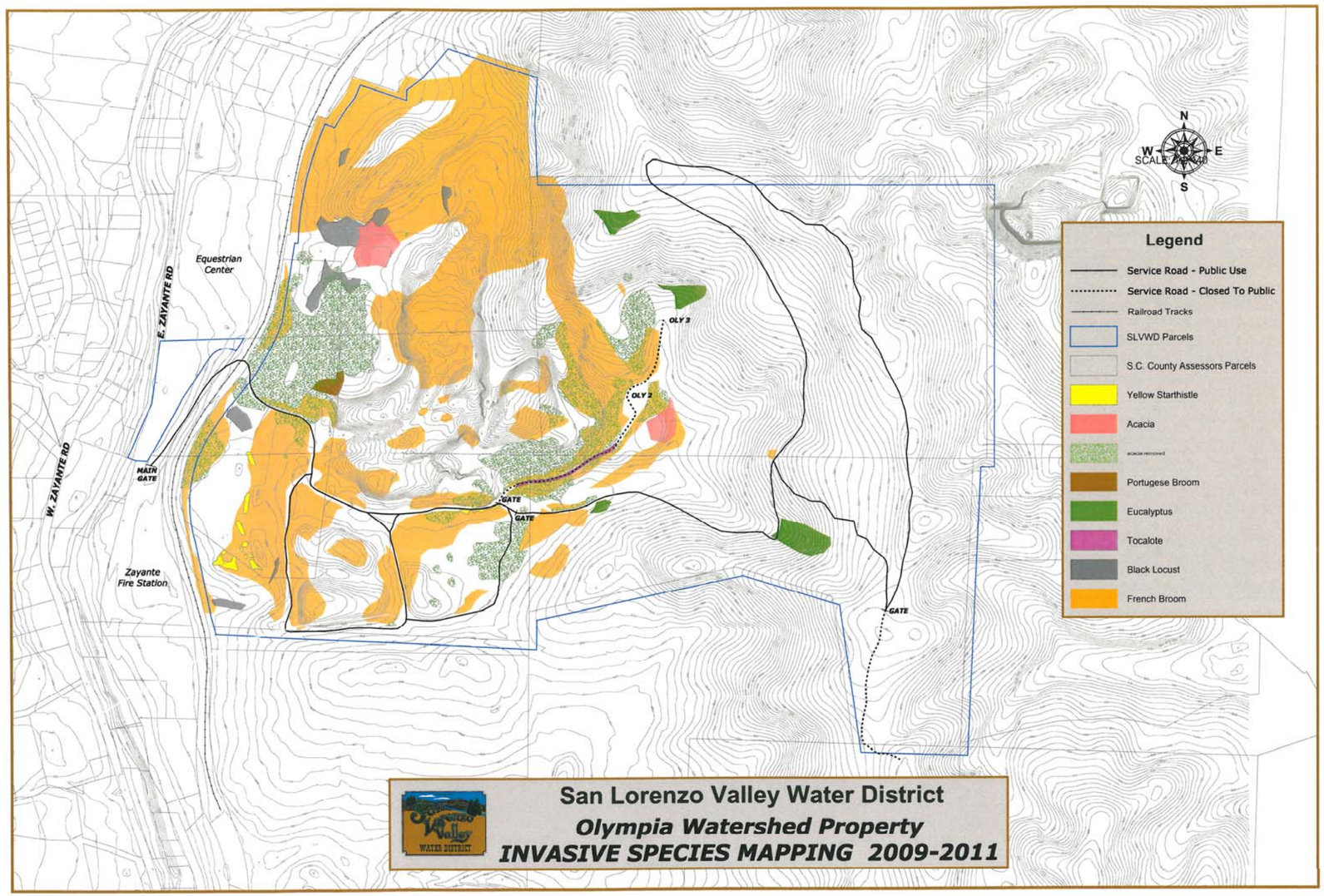
Canopy gaps important for maintaining plant diversity are likely also important for the sandhills fauna, which is impacted by canopy closure due to fire exclusion. Animals may rely on the gaps in the canopy which provide habitat conditions dissimilar from the closed canopy environment including a greater availability of sunlight (e.g. for thermoregulation) and a higher diversity of plants which may provide a variety of food sources not found in the closed canopy (e.g. flowering plants for pollinators, seeds of herbaceous plants for granivores, etc.). Indeed, shrub encroachment due to fire suppression in sandhills chaparral communities is cited as one likely cause for the likely extirpation of the Santa Cruz kangaroo rat from the Bonny Doon Ecological Reserve and Wilder Ranch sandhills sites during the past 20 years (Bean, 2003).

2.3.1.4 Impacts to sandhills animals at Olympia Watershed

The persistence of the Zayante band-winged grasshopper continues to be threatened by habitat loss, and degradation of habitat due to illegal recreation and the invasion and spread of exotic plants (McGraw, 2004). The Mt. Hermon June beetle is threatened by habitat degradation from past mining, recreational trespass, and night lighting, which attracts adult males away from their habitat and may reduce reproduction and thus population growth (McGraw, 2004). Habitat should improve once some of the mining debris is removed, and trespass is reduced through fencing, signage, and patrol.

The rare mountain king snake is widely sought by poachers. Large black rubber tarps, which were deposited on the ground by District staff years ago, had been harboring many of these snakes until the District removed them in October 2011. Poachers frequented these areas, looking under the tarps for snakes. A local herpetologist advised District staff to remove the tarps before cold weather sets in, because reptiles that find shelter underneath the tarps are least impacted then (Mulks, personal communication, 2011). The District removed the tarps shortly thereafter.

Figure 2-6. Invasive plant species and areas of control and eradication efforts at the Olympia Watershed proper



The contour map above shows areas of invasive plants, by species, and areas where invasive acacia have been removed on the Olympia Watershed property.

2.3.1.5 Upland mixed conifer forest

On the eastern half of the property, the steeply-sloped terrain hosts mixed conifer forests including redwoods, Douglas firs. Hardwoods include coast live oak, tan oak and madrone. Invasive exotic eucalyptus trees and French broom are the primary invasive exotic plant species in this area.

2.3.1.6 Riparian woodland

Riparian woodland tree species include native black cottonwoods and white alder. More information is needed to document plant and animal species present in riparian woodland areas.

2.3.1.7 Data gaps

Part I: Existing Conditions Report identified two data gaps with regards to biotic resources on District watershed lands:

1. The District has not yet established measurable baselines of biotic resource quantities, conditions, and locations.
2. The District has not yet mapped and analyzed historical and current vegetation, natural and induced succession, current seral stages of the vegetation or sensitivities to pollution and climate change.

Since publication of Part I: Existing Conditions Report in 2009, the District has made significant progress in establishing measurable baselines of biotic resources on the property, especially with regards to surveying and mapping of endangered plant species as well as invasive plant species. However, the District still needs to determine the distribution of the Zayante band-winged grasshopper

Consideration of addressing these data gaps at the Olympia Watershed property are discussed in paragraphs, 2.3.4, Biotic resources management alternatives, and 2.3.5 Biotic resources recommended measures.

2.3.2 Biotic resources management issues

In consideration of the Management Plan's goals and the findings of the ECR, the key issues affecting biotic resources at the Olympia Watershed property are listed below:

- Loss of habitat, degradation and fragmentation of habitat from past sand quarrying;
- Loss of habitat, degradation and fragmentation of habitat from longstanding, uncontrolled recreational use, especially from equestrian use, motor bikes, and mountain bikes;
- Loss of habitat, degradation and fragmentation of habitat from invasive exotic plant species;
- Fire suppression has impacted sand chaparral/sand parkland biotic communities;
- Loss of native reptiles and amphibians from poaching;
- Lack of information about biotic resources.

2.3.3 Biotic resources opportunities & constraints

Opportunities

- Grant funding may be available for invasive exotic plant species control and restoration of sensitive species in the sand chaparral/sand parkland biotic communities;
- Protection and enhancement of native plant and animal species can aid in restoring and enhancing ecosystem functions, including the hydrologic cycle;
- A local community of volunteers could be engaged to assist in controlling invasive species;
- Riparian areas and mixed-evergreen forests have high value to wildlife and overall habitat value to the region. Opportunities for habitat enhancement include removal/control of invasive non-native plant species;
- The presence of intermediate seral stage forests present an opportunity for recovery of biologically valuable conifer old growth stands within portions of the Olympia Watershed property;
- Active vegetation management could reduce invasive exotic vegetation such as French broom, which would also reduce fire hazard;
- Active vegetation management could enhance the extent and quality of sensitive plant communities, such as sand chaparral/sand parkland;
- Improvement in native plant communities will enhance native wildlife habitats;
- Management of upland mixed conifer forests toward late seral stage would support water quality protection and enhancement.

Constraints

- The District is required to monitor biotic conditions on site for ten years as part of the USFWS Partners Grant;
- Protection of sensitive resources from illegal recreational uses is difficult and costly;
- Fencing to protect sensitive areas must be selected to cause as little impact to wildlife as possible;
- Considerable planning, public outreach and notification would be required to enable a successful prescribed burning program;
- Full eradication of invasive, exotic vegetation is not feasible without a continued and dedicated effort over many years.

2.3.4 Biotic resources management alternatives

The following alternatives are identified for managing biotic resources:

Alternative 1: Collection of biotic resources data to address identified data gaps (see paragraph 2.3.1.7);

Alternative 2: Active management of vegetation communities and physical habitat to improve conditions for native plant and wildlife populations;

Alternative 3: Passive management of vegetation communities and physical habitat to improve conditions for native plant and wildlife populations;

Alternative 4: Combine aspects of Alternatives 1 – 3 as appropriate.

Discussion

Alternative 1 is necessary to determine whether Alternative 1 and/or 2 are appropriate in different areas on the property, but would not be sufficient on its own.

Alternatives 2 and 3 differ in their use of active versus passive efforts to improve ecology and wildlife habitat. Alternative 2 would include management measures that improve habitat through active means, such as invasive species control and prescribed burns. Alternative 3 would allow areas to be left alone to move toward an ecological condition that supports native plant and wildlife populations. With Alternative 3, the primary management measure is no activity at all in certain areas of the Olympia Watershed property.

The preferred management strategy is Alternative 4, which combines Alternatives 1, 2, and 3. Areas lacking significant impact and showing signs that ecological processes are already moving toward a preferred condition would require monitoring, but no active management. Areas currently in a degraded state would be actively managed through enhancement projects or other measures that would move the system toward preferred conditions. Combining Alternatives 2 and 3 would benefit wildlife populations by improving physical habitat conditions in degraded areas, while protecting existing habitat already supporting these populations.

2.3.5 Biotic resources recommended measures

The following measures, BIO-1, BIO-2, and BIO-3 are recommended to implement management Alternatives 1, 2, and 3, respectively for the Olympia Watershed property:

BIO-1: Prioritize and address remaining data gaps applicable to biotic resources on the Olympia Watershed property

BIO-1 Description

BIO-1 is a measure aimed at implementing Alternative 1, to prioritize and begin filling data gaps applicable to the Olympia Watershed property, as noted in Part I: Existing Conditions Report and Part II: Goals, Objectives, and Policies.

Since 2008, District staff has made significant progress in addressing the lack of baseline documentation of both native sensitive plant species and invasive exotic plant species on the property. Staff secured grant funding from both the U.S. Fish and Wildlife Service and the State Weed Management Area for projects to control and map invasive exotic plant species within sand chaparral/sand parkland communities (Figure 2-6). Further work has identified and mapped special status vegetation under the District's Education Grant program. GPS identification of biotic resources has been coordinated with the District's GIS Department to document and map these resources.

The status of addressing data gaps identified for biotic resources on the Olympia Watershed property is listed below in the following areas:

1) Identify and map all creeks and wet areas (Preliminary mapping completed; see Figure 2-2);

2) Survey aquatic organisms in creeks and wet areas, identifying any sensitive species (incomplete);

3) Complete survey of Zayante band-winged grasshopper and the Mt. Hermon June beetle;

4) Assess aquatic conditions and riparian habitat (incomplete);

5) Assess biotic resources and conditions in the mixed conifer forest (incomplete);

6) Baseline map of endangered plant species (complete; Figure 2-5 & proprietary maps) and invasive species in sand chaparral/sand parkland communities (complete; Figure 2-6).

BIO-1 Cost

Projects 2, 4, and 5 would be suitable for funding by the District's Education Grant Program. Each project could be funded for up to $3,000 for a total cost of $9,000. Forest conditions may also be assessed when the District completes a carbon inventory of all of its forested lands. Project 3 would require the work of a consultant, which could be determined through the RFP process.

BIO-1 Future Conditions

Initial survey projects should identify and use quantifiable baseline indicators that could be monitored in the future to detect significant changes.

BIO-1 Monitoring

Appropriate monitoring programs should be established by initial survey projects.

BIO-2: Designate and maintain sand chaparral/sand parkland biotic communities as "special protection areas" requiring active management

BIO-2 Description

BIO-2 is a measure aimed at implementing Alternative 2, active management of vegetation communities and physical habitat to improve conditions for native plant and wildlife populations. The extremely rare sand chaparral/sand parkland biotic communities on the property were designated as "special protection areas" by Resolution 34 (10/11), which was established to protect these unique resources (See also Recreational Uses). Staff took the following actions during fall and winter 2011 pursuant to Resolution 34:

1) Public use has been prohibited, except as authorized by a District permit, within special protection areas;

3) Special protection areas have been delineated with wildlife sensitive fencing, and the District has hired a part-time caretaker to patrol the area on foot;

4) Both interpretive signs and signs prohibiting public use of special areas are being installed;

5) Baseline conditions for special status plant species on the property have been mapped and documented.

The following actions are needed under BIO-2:

1) Create and maintain a volunteer program to control/eradicate invasive species within special areas (See Figure 2.6);

2) Using baseline conditions established for special status species, monitor change in special status species populations within special areas;

3) Monitor and maintain fencing and signage;

4) To reduce the introduction of invasive seed, restrict vehicular use to that which is necessary to service and maintain District property.

BIO-2 Cost

Costs associated with designating a special protection area and improving habitat conditions for special-status species within this zone accrue from invasive species control programs and monitoring to determine the effectiveness of the protected designation. Invasive species control programs to date have been partially funded by federal and state funding. Routine maintenance will require staff time to organize and oversee a volunteer program. Monitoring could be accomplished by staff, with the help of local experts and volunteers.

BIO-2 Future conditions

Maintenance of the special protection zone is vital to the populations of special status species on the Olympia Watershed property. Without such maintenance, population numbers could potentially be reduced to a level that requires action by species protection agencies such as the U.S. Fish and Wildlife Service.

BIO-2 Monitoring

Periodic monitoring of special status species is needed on the Olympia Watershed property to assess the success of District programs to control/eradicate invasive exotic plant species to enable repopulation by native species in the special protection zone. Specific monitoring requirements are required by USFWS Partners Grant and Weed Management Area grants. Maps, documentation and photographs have established the baseline data.

BIO-3: Continue managing upland mixed evergreen forests toward late seral stage

BIO-3 Description

BIO-3 is a measure aimed at implementing Alternatives 2 and 3 within the upland mixed evergreen forest. BIO-3 includes both active and passive management of this area to improve conditions for native plant and wildlife populations. BIO-3 is aimed at restoring habitat for species that prefer old-growth habitat. Managing forested areas for late seral stage will increase carbon sequestration, which serves to reduce the District's overall carbon footprint. The native forests in the upland area will be allowed to proceed to late seral conditions through natural succession, and through control/eradication of invasive/exotic plant species such as eucalyptus and French broom.

The District should manage toward late seral stage using the following actions:

1) Designate and map the uplands mixed conifer forest on the eastern portion of the Olympia property as a Late Seral Management Area (LSMA) to preserve/restore biodiversity and ecological structure and the processes associated with old-growth redwood/Douglas-fir forests;

2) Document existing conditions within the LSMA, including vegetation cover, distribution of large snags, large down logs, residual old-growth conifers, old-growth structures such as broken tops, large limbs, tree hollows, topography, aspect, and soil type.

3) Actively control and/or eradicate invasive plant species throughout the uplands forest area, including eucalyptus trees;

4) Restrict vehicular traffic to that which is necessary to service and maintain District property in order to reduce the risk of introduction of invasive seed and the pathogen *Phytophtera ramorum* or other non-native pathogens into the LSMA.

BIO-3 Cost

The cost of documentation of existing and baseline conditions would be determined by a competitive bid process. Biotic assessment of uplands forest conditions could be included in the request for proposal to complete a carbon inventory for all of the District forestlands. For projects aimed at control and eradication of invasive species, grant funding through the District's Education Grant Program, or through USFWS may be available. Volunteer work could substantially reduce the costs of invasive species control.

BIO-3 Future Conditions

The desired future condition is late seral stage forest. Characteristics of late seral stage forest include large diameter trees with large limbs in the upper half of the live crown, large downed logs on the forest floor, large snags, and an uneven-aged stand structure.

BIO-3 Monitoring

Baseline conditions should be documented, including a carbon sequestration inventory (see Climate Change section 2.8). Subsequent modeling of tree growth could estimate increasing quantities of carbon stored in maturing forest stands.

BIO-4: Improve protection of native reptiles from poaching

BIO-4 is a measure aimed at implementing Alternative 2 within the sandy areas of the property known to harbor prolific snake populations. In October 2011, District staff removed the black tarps partly buried in sensitive sandhills/sand parkland. The tarps were known to harbor native reptiles and were often visited by poachers. The tarp removal project was approved and monitored by the USFWS under the recovery permit for endangered species held by consultant Jodi McGraw. Herpetologist Mitchell Mulks was on site to capture and release the numerous rattlesnakes and other native reptiles and amphibians to other suitable habitat on the property.

BIO-4 includes the following actions:

1) Document the number and types of reptiles and amphibians re-located after the tarp removal;

2) Post signs stating that poaching is prohibited on the property;

3) Patrol for poachers.

BIO-4 Cost

No cost for documentation to date. Signage and patrol costs are included in other projects.

BIO-4 Future Conditions

Tarp removal should benefit reptile and amphibian populations because poachers will no longer have easy access to animals living under the tarps.

BIO-4 Monitoring

Baseline conditions have been documented (Mulks, 2011). Future monitoring could be funded through the Education Grant program.

BIO-5: Maintain a monitoring database including photographs and documentation of projects for adaptive management purposes

BIO-5 is a key component of all of the biotic resource alternatives (Section 2.3.4).

For Alternative 1, the monitoring database will store pertinent biotic resources data that is collected to address identified data gaps.

For Alternative 2, the monitoring database will house baseline data to measure success of projects aimed at improving conditions for native plant and wildlife populations through active management.

For Alternative 3, the monitoring database will house baseline data to measure success of projects aimed at improving conditions for native plant and wildlife populations through passive management.

BIO-5 includes the following actions:

1) Maintain a digital monitoring database documenting baseline conditions, descriptions of projects, and monitoring data to assess performance of projects toward achieving desired outcomes;

2) Make the database accessible to the public on the District website, with the exception that sensitive information password protected.

BIO-5 Cost

Primary costs are staff time for the network specialist to create and maintain the website, and for the environmental analyst to collect the information.

BIO-5 Future Conditions

Making information available and up to date will increase public awareness of District natural resources and increase funding opportunities for District watershed projects.

BIO-5 Monitoring

Success of the website could be monitored by customer surveys, as well as success in obtaining grants for future projects.

2.4 Fire management

In addition to meeting the District's primary watershed management goal, all prescribed management activities to address fire must also meet the following secondary goals:

***Secondary goal**: Protect the watershed, adjacent urban areas, and the public from fire and other hazards.*

***Secondary goal:** Consider climate change impacts and reduction of greenhouse gases in all watershed management decisions;*

***Secondary goal:** Review and revise management decisions in response to changing conditions.*

2.4.1 Review of existing conditions: Fire management

2.4.1.1 Fire ecology

Fire is part of an important cycle of natural processes. Historic fire regimes of Native Americans included intentional burning. The San Lorenzo watershed contains substantial areas of fire-adapted vegetation, reported to burn at historical intervals of typically 40 to 80 years (Hecht and Kittleson, 1998). Fire suppression, the predominant management strategy in the San Lorenzo River watershed for the past century, is drastically altering the natural community structure of the rare sandhills plant communities on the Olympia Watershed property, which features many species adapted to recurring fire. In the absence of fire, the increased density of woody vegetation and accumulation of litter on the soil surface can eliminate species that require open conditions created and maintained by fire.

2.4.1.2 Oak woodland plant communities

The deciduous California valley oak *(Quercus lobata)* is conspicuous along the western boundary of the Olympia Watershed property, with remarkable specimens at the service road entrance. The valley oak is the largest of all California native oaks, reaching heights up to 120 feet. Mature valley oaks are typically 1 – 4 feet in diameter, but old specimens have been measured up to 8 feet. Valley oaks are not fire-tolerant, and typically live in well-drained bottomland soils, streambeds, and lower foothills.

Coast live oak (*Quercus agrifolia*) is found on the property as well.

To date, Sudden Oak Death, a tree disease caused by the plant pathogen *Phytophthora ramorum*, has not been identified on the property. The disease kills some oak species and has had devastating effects on forests in California and Oregon.

2.4.1.3 Uplands redwoods

Predominately redwood, mid-seral stage *(Sequoia sempervirens)* forest stands in the uplands of the Olympia Watershed are considered to be fire tolerant, as mature trees are seldom killed by fire (Sugihara et al. 2006). However, recurrent small to moderate intensity ground fires play an important role in redwood ecosystems by creating or enlarging basal hollows that provide an important habitat for wildlife (Sugihara et al. 2006). Because it is the driest time of year, critical fire weather typically occurs in July through October. However, CalFire historical files for the Santa Cruz Mountains indicate that extreme fire conditions, including low humidity and high winds, have frequently occurred from August through early January. In terms of fuel, redwoods are relatively free of volatile oils and resins, making them somewhat fire-resistant (Lindquist, 1974; as cited by Agee, 1993). In mature upland stands, low intensity fires generally do not kill the overstory conifers, but will kill the tanoaks and other trees (Agee, 1993). Moderate severity

fires that scorch the crowns of overstory conifers will generally kill mature Douglas firs, but not redwoods, which will re-sprout and grow a new crown (Agee, 1993).

2.4.1.4 Uplands mixed evergreen forest plant communities

Mixed evergreen forest plant communities are interspersed with the redwood stands in the Olympia Watershed uplands, occupying drier and more inland areas. Common trees include Douglas fir (*Pseudotsuga menziesii*), interior live oak (*Quercus wislizenii*), tan oak (*Lithocarpus densiflora*), madrone (*Arbutus menziesii*), California bay (*Umbellularia californica)*, California buckeye (*Aesculus californica*), and Santa Cruz Mountain oak (*Quercus parvula* var. *shrevei*). Understory plants include Ceanothus, coffee berry, hazelnut, ground rose, and poison oak.

2.4.1.5 Sand chaparral/sand parkland communities

Sandhills chaparral communities have undergone the most dramatic shift in structure due to plant succession in the absence of fire. Aerial photographs during the past 60 years have revealed large increases in woody vegetation and concomitant reductions in open sand areas during this period of fire suppression. The resulting increase in canopy closure reduces the abundance of open sandy habitat required by important sand chaparral and sand parkland plant species. Research demonstrated that plants cannot complete their life cycles in the dense leaf litter and low light of the closed canopy environment (McGraw, 2004). McGraw (2004) describes goals and aspects of fire management specific to the unique sandhills and sand parkland ecosystems:

> The goal of fire management in the sandhills is to reverse the negative impacts of fire suppression and thereby enhance the natural community structure and facilitate population growth and persistence of the endangered species in the sandhills.
>
> Managing sandhills habitat with fire involves the use of prescription burning whereby fires are deliberately ignited, actively monitored and managed, and extinguished following a specific burn plan. Developed well in advance of fire management, a burn plan details the management goals of the treatment, provides a thorough description of the treatment area, determines the constraints of burn treatments, and provides a detailed plan for the burn including thorough safety information as well as the burn prescription - a specific statement of the desired fire behavior, smoke production, and environmental conditions that will be desired for safe and effective execution of the treatment.

The District began a program of acacia eradication and broom control on the Olympia Watershed property in 2008, partially funded by the U.S. Fish and Wildlife Service and the Santa Cruz County Weed Management Area. Existing stands of invasive exotic species have been surveyed and mapped. The combination of invasive exotic species and endangered species complicates fire management planning, yet the benefits of fire management are clear, both in terms of reducing the fuel load and in terms of enhancing the native habitats.

2.4.1.6 Data gaps

Part 1: Existing Conditions Report and Part II: Goals, Objectives, and Policies identified the following data gaps, which would apply to the Olympia Watershed property in regard to fire management:

1. The District has not completely mapped its road system, emergency access points, or fire-fighting emergency fuel breaks and facilities. (Note: The District completed mapping of the road system at the Olympia Watershed in October 2011).

2. The District has not yet mapped and analyzed fire hazards more precisely than CalFire's broad maps, in order to conduct a wildfire risk analysis and develop specific emergency response readiness for fire.

2.4.2 Fire management issues

In consideration of the District's Watershed Management Plan, Part II: Goals, Objectives, and Policies, and the findings of Part I: Existing Conditions Report, the following are key issues for the Olympia Watershed property with regards to fire management:

2.4.2.1 Create defensible space for District infrastructure

The District needs to establish a defensible space around its wellheads and other infrastructures, especially around Olympia Well #3, where a canopy of valley oaks is becoming established. Large eucalyptus trees growing up the canyon behind the well house also present a fire hazard. The area should be cleared of non-native vegetation within a 30 foot radius, and within a 70-foot radius, ladder fuels including low hanging branches on native trees should be removed.

2.4.2.2 Estimating fire risk

Estimating fire risk, in terms of lives and residential structures, requires assessment of local topography, adjacent fuels, the potential for structures to ignite, and the existence of escape routes from dwelling, neighborhoods, trespass, smoking and motorized vehicles.

While emergency response procedures are defined generally for District operations, there is no formalized fire management plan for the Olympia watershed property.

CalFire currently has a regional fire plan which could be updated to incorporate information about District lands. Following recent major fires in the county, CalFire has initiated the Community Wildfire Protection Plan (CWPP) process. No FireSafe Council or CWPP process has yet been initiated in the locale (fall 2011), according to Zayante Fire Station staff.

Invasive populations of French broom on District property at the Olympia Wellfield have increased the fuel load and the risk of catastrophic fire.

Uncleared areas beneath and around power poles on the property also present a fire risk. These areas should be cleared.

2.4.2.3 Fire ignition sources

Probability of a human ignition is significant on the Olympia watershed property because of recreational use and trespass, especially involving motorized vehicles and illegal campfires. The

District has already begun to address these ignition problems by limiting recreational use to the service road, by fencing the road, and providing signage.

Another ignition source is from sparks falling from PG & E transformers during power surges. Fires have started in the past from these sparks (Rogers, personal communication 2011). Clearing the areas of brush below and around the poles would reduce the probability of ignition from this source.

Adding fire hydrants to the property would reduce the fire risk from ignitions caused by sparks or other sources.

The District's existing policies of controlling invasive exotic species and managing its forest lands toward old growth help to reduce the risk of a catastrophic fire, and the potential impacts to water quality in the aftermath of a wildfire.

2.4.3 Fire opportunities & constraints

The following opportunities exist for fire management on the Olympia Watershed property:

Opportunities

- The District could better protect its infrastructure by establishing and maintaining defensible space appropriately;
- The Olympia Watershed property could be restored to a more natural, pre-European fire regime;
- Invasive weedy species, such as French broom and acacia, could be controlled through a small-scale burning program;
- A fire management plan can be developed in cooperation with the California Department of Forestry and other local fire protection agencies;
- An opportunity exists to cooperate with adjacent landowners to develop shaded fuel breaks to reduce ignition and ladder fuels;
- Sand chaparral and sand parkland communities could be enhanced through a program of controlled burns;
- Fire hazard could be lessened by controlling invasive exotic acacia and broom, and eucalyptus, which serve as ladder fuels, increasing the risk of catastrophic crown fires;
- The risk of catastrophic fire could be reduced by adding fire hydrants to the property.

Constraints

- There is considerable risk to the public associated with controlled burns if they escape the burn perimeter;
- Activities associated with creating a defensible space by reducing vegetation and reducing the volume of ladder fuels will likely increase the risk of erosion and introduction of non-native invasive species through land disturbance;
- Some fire management activities have the potential to impact endangered species, such as Zayante band-winged grasshopper and Mt. Hermon June beetle.

2.4.4 Fire management alternatives for the uplands forest area

Fire suppression, logging, and introduction of exotic invasive species over the past 100 years have significantly altered historic fire regimes. The result is a younger native forest ecosystem with more ladder fuels, and some infestations of invasive species, including acacia, broom and eucalyptus. Additionally, the sand chaparral and sand parkland communities have decreased in size as invasive, exotic acacia and French broom encroach on these areas once sustained by periodic high intensity burns.

Management measures and alternatives from a fire and fuel perspective should focus on moving toward the historic ecological conditions that allowed fire to move through the landscape without catastrophic consequences. Historic conditions likely consisted of a mosaic of vegetation sand chaparral and sand parkland communities on the western portion of the property and old growth mixed redwood stands on the eastern portion.

To move towards a more historic fire regime, management should encourage old-growth dominance in the uplands forest areas and reduce ladder fuel, where applicable. To accomplish this goal, the following management alternatives are available for the uplands forest on the eastern portion of the property:

Alternative 1: Actively manage the uplands forest ecosystem with such practices as selective timber harvesting to thin the forest and prescribed burning;

Alternative 2: Allow old-growth stands to develop naturally over time, while actively managing exotic vegetation, invasive species, and manual removing ladder fuels and fallen branches;

Alternative 3: Leave the forest alone, allowing time to achieve historic forest ecosystem based on a natural fire regime;

Alternative 4: To prevent the spread of fire from or into the property, create shaded fuelbreaks adjacent to uplands access roads, where feasible.

Discussion

Selective timber harvesting is not generally advised to reduce fire hazard, especially in unevenly aged stands where late seral stage characteristics are already present (Just, E., and C.A. Dicus, 2006). Slash left on the ground increases the risk of ignition, and openings created in the canopy allow sunlight to dry the forest floor. Furthermore, selective thinning targets larger trees because of their timber value, the same trees that are the most fire resistant. There are considerable risks and benefits to prescribed burning. The risks involve the unintended, uncontrolled spread of fire, while the benefits involve lessening the risk of catastrophic fire in the long-term. Alternative 2 allows development of native old-growth stands with active management of exotic vegetation and manual removal of ladder fuels, but would probably not be sufficient to stop a catastrophic wildfire from spreading. Under Alternative 3, no active management could result in increased liability to the District in the event a fire is initiated on District land and spreads to adjoining properties. Alternative 4 would provide some level of protection against the spread of fire, using existing access roads in the uplands area. Though shaded fuel breaks are not 100% effective, they can keep ground fires from becoming crown fires which are much more intense and damaging. In the case of a fire initiating on District land, the District must be able to show that all reasonable steps were taken to limit its spread.

2.4.5 Fire management recommended measures for the uplands forest area

To implement Alternative 2, the first recommendation for managing the uplands forest for fire management is the same as the recommendation BIO-3:

Fire-1 (BIO-3): Continue managing upland redwood and mixed evergreen forests toward late seral stage

Fire-1 (BIO-3) Description

Fire-1 is a measure aimed at implementing Alternative 2 within the upland redwood and mixed evergreen forest. Fire (BIO-3) includes both active and passive management of this area to improve conditions for fire management. Fire (BIO-3) is aimed at increasing fire resistance through succession toward late seral stage forest. The LSMA will be allowed to proceed to late seral conditions through natural succession, and through control/eradication of invasive/exotic plant species such as eucalyptus and French broom, which are known to increase fire hazard.

The District should manage toward late seral stage using the following actions:

1) Designate the uplands mixed conifer forest on the eastern portion of the Olympia property as a Late Seral Management Areas (LSMA) to increase fire resistance;

2) Document existing conditions within the LSMA, including vegetation cover, distribution of large snags, large down logs, residual old-growth conifers, old-growth structures such as broken tops, large limbs, tree hollows, topography, aspect, and soil type;

3) Actively control and/or eradicate invasive plant species throughout the uplands forest area, including eucalyptus trees;

4) Restrict vehicular traffic to that which is necessary to service and maintain District property in order to reduce the risk of introduction of invasive seed and non-native pathogens such as *Phytophtera ramorum* into the LSMA.

Fire-1 (BIO-3) Cost

The cost of documentation of existing and baseline conditions would be determined by a competitive bid process. Grant funding and volunteer work could substantially reduce the costs of control and eradication of invasive species.

Fire-1 (BIO-3) Future Conditions

The desired future condition is late seral stage forest. Characteristics of late seral stage forest include large diameter trees with large limbs in the live crown, thick bark, and "defects" present (i.e., broken tops, broken limbs, cavities or hollows) (Singer, 2009). Other characteristics are large diameter snags, large downed logs on the forest floor, and an uneven-aged stand structure.

Fire-1 (BIO-3) Monitoring

Baseline conditions should be documented, including a carbon sequestration inventory. Subsequent modeling of tree growth could estimate increasing quantities of carbon stored in maturing forest stands.

Following is the second recommendation for managing the uplands forest for fire management through Alternative 2:

FIRE-2 Use shaded fuel breaks to reduce ignition and ladder fuels

Fire-2 Description

The objective of this recommendation is to prevent fire from entering the Olympia Watershed property from surrounding areas or spreading from the property to the surrounding area. Shaded fuel breaks should be established by bordering existing roads where possible. This action will involve working with adjacent landowners and setting up partnerships with landowners outside the District's ownership. Establishing shaded fuel breaks would need to be considered carefully so that biological resources were not degraded within sensitive habitats. Fuel breaks will require maintenance and may cause the spread of weeds. For this reason, construction of fuel breaks inside the Olympia Watershed property should only be considered once perimeter fuel breaks have been successfully established and maintained.

The District should use shaded fuel breaks to reduce the risk of fire spreading into the tree canopies by ladder fuels using the following steps:

1) Identify critical areas outside of existing roads where fuel breaks are needed;
2) Establish fuel breaks only in areas where impacts to sensitive biotic resources would be minimized;
3) Carefully develop prescriptions to avoid and minimize impacts to sensitive plants and animals;
4) Keep existing roads clear of brush;
5) Engage with the Zayante Fire Department and CalFire to partner with CWPP and/or FireSafe Council efforts to identify and implement fuel breaks outside of areas with sensitive species.

Fire-2 Cost

Establishing a shaded fuel break next to an existing road would minimize costs of implementation and maintenance. Maintenance of shaded fuel breaks should be conducted a minimum of every three years to remove new understory growth and encourage canopy closure and shading. In addition, newly invading exotic vegetation would need to be removed, initially on a yearly basis.

Fire-2 Future Conditions

Well-maintained fuel breaks adjacent to District service roads have resulted in reduced spread of invasives.

Fire-2 Monitoring

Monitoring of the newly established shaded fuel break should be conducted on a yearly basis to inventory and to apply control measures for exotic invasive weeds (e.g.; French broom).

2.4.6 Fire management alternatives for sandhills/sand parkland areas

To move towards a more historic fire regime, the District must encourage restoration of the native sandhills/sand parkland vegetation, primarily through control/eradication of invasive

exotic vegetation, which is a known fire hazard. To accomplish this goal, the following management alternatives are available for this community on the western portion of the property:

Alternative 1: Commit to the long-term, active control/eradication of invasive exotic plant species using appropriate techniques *including prescribed broadcast burning*, and monitor the success of repopulation by native species;

Alternative 2: Commit to the long-term, active control/eradication of invasive exotic plant species using appropriate techniques *excluding prescribed broadcast burning*, and monitor the success of repopulation by native species;

Alternative 3: Allow invasive exotic species to continue expanding into native habitat;

Alternative 4: Prohibit public access in sandhills/sand parkland areas and unnecessary vehicular traffic on District service roads to decrease the spread of invasive plant seed.

Discussion
Alternative 1 would be the most beneficial to the native species, since plants of the sandhills/sand parkland communities are fire dependent; controlled burns also reduce the fuel load to help reduce the threat of catastrophic fire; however, controlled burns can get out of control and can cause considerable anxiety and distrust on the part of neighbors.

Alternative 2 would be beneficial to native species, reduce the long-term risk of fire, and would be more acceptable to neighbors.

Alternative 3 would mean the eventual demise of native species which conflicts with the District's primary goal, and would increase the long-term risk of fire.

Alternative 4 is necessary to keep the seedbank of invasive species at bay, and also reduces the risk of ignition.

Alternatives 2 and 4 are recommended as complementary measures that would improve native habitat and decrease the long-term risk of fire.

2.4.7 Fire management recommended measures for sandhills/sand parkland areas

FIRE-3: Designate sand chaparral/sand parkland biotic communities as a "special protection area" requiring active management.

[Same as BIO-2]

FIRE-4: Reduce ignition sources

Fire-4 Description

There are preventative actions that can help minimize the probability of ignition on the Olympia Watershed property. Ignitions will most likely occur as a result of human activity, and must be considered in recreation management options.

Management measures designed to reduce ignition sources include, but are not limited to, the following:

1) Restrict access during periods of high fire risk;
2) Develop criteria to define periods of high fire risk (e.g., low fuel moistures or hot, dry, windy conditions);
3) Minimize illegal entry;
4) Increase patrols during high fire risk periods;
5) Post signage to educate the public on the risk and impacts of fire.

Fire-4 Cost

The cost of implementing Fire-4 will vary considerably from year to year, depending upon the weather-related fire risk.

There would be no additional cost for signage or fencing, since that expense is included in service road fencing project budget, which has already been approved by the Board.

Fire-4 Future Conditions

If Fire-4 were not implemented, the probability of a fire occurring on the Olympia Watershed property would increase. Considerable cost to the District could result if a fire were to occur, both in terms of impacts to District wells and increased liability if the fire were to spread to adjacent private lands.

Fire-4 Monitoring

Constant monitoring of weather patterns during dry summer months would be required. Monthly monitoring of controlled access points should be conducted to determine if existing infrastructure is limiting access. If access is detected, corrective actions should be taken.

FIRE-5: Develop a comprehensive plan to prepare for the occurrence of fire

Fire-5 Description

The District should prepare for the occurrence of fire on the Olympia Watershed property. The District currently has no comprehensive fire management plan. No management alternative can completely reduce the threat of a large-scale fire with resulting impacts to District resources and infrastructure. A comprehensive fire management plan would help reduce undesirable effects stemming from such a wildfire. Fire fighting agencies should be provided with a copy of the plan, including maps of sensitive areas and recommended suppression guidelines.

The District should develop a comprehensive plan to prepare for the occurrence of fire that includes the following steps:

1) Identify and map fire hazards throughout the property and conduct a wildfire risk analysis;

2) Develop a specific emergency response readiness plan for fire;

3) Map the road system on District lands, including emergency access points, fire-fighting emergency fuel breaks and facilities. Include roads to the east and north of the property, as mapped in the County Wide Community Wildfire Protection Plan (CWPP);

4) Maintain existing road infrastructure to allow fire personnel to effectively respond to and suppress fires on the property. Periodically evaluate the condition of the shaded fuel breaks and fire access roads on the property with CalFire and Zayante Fire Department staff;

5) Create and maintain defensible space around District infrastructure;

6) Place fire hydrants at appropriate locations to increase the availability of water for wildfire suppression;

7) Focus fuel management activities adjacent to developed areas, District facilities and improvements, major egress and emergency ingress routes, areas of crown fire potential, and potential and existing fuel breaks;

8) Control the spread of broom and other invasive exotic plant species, which are known to increase fire hazard, and eventually eradicate them from District lands;

9) Map sensitive areas and request that aerial suppression methods be used there to the extent feasible, so that fire response agencies can avoid using heavy equipment in these areas.

Fire-5 Cost

The cost of developing a comprehensive fire management plan could be minimal if the project were developed under the CWPP process or through a FireSafe Council.

Fire-5 Future conditions

No action on this recommendation would leave the District without a specific action plan in the event of a fire. Implementing this recommendation would provide the District with a document to guide fire suppression and post-fire responses that take into consideration the overall management goals adopted by the District, specifically for these lands. The result would be a prudent response to fire risk on the property, recognition of the fact that a fire will eventually occur, and management measures that will protect the District's ground water sources at the Olympia Watershed property.

Fire-5 Monitoring

Not applicable to this recommendation.

2.5 Recreational resources

In addition to meeting the District's primary watershed management goal, all prescribed management activities to recreational, cultural, historical and educational resources must also meet the following secondary goals, as well as others as described in the following sections.

Secondary goal: *Preserve and enhance cultural and historical resources of the watershed;*

Secondary goal: *Enhance public awareness of water quality, water supply, conservation, and watershed protection issues.*

2.5.1 Review of existing conditions re: Recreational resources

Prior to the District's approval of Resolution 34 in June 2011, which authorized hiking, dog-walking, and equestrian use only on designated District service roads, the sole recreational use authorized at the Olympia Watershed property was horseback riding, as specifically limited by a

memorandum of understanding (MOU) between the District and the Santa Cruz County Horsemen's Association. This MOU restricted equestrian use to designated District service roads.

2.5.1.1 Unauthorized recreational use

Because the property is the most easily accessible of all of the District's lands, unauthorized recreational use has been a longstanding problem. Mountain biking, off-highway vehicles (OHVs) and off-trail equestrian use have all caused degradation of habitat. In addition, several sandhills habitat patches, especially those featuring rock outcrops, sand parkland ridges, or other promontories, have served as congregation sites for local youths. The abandoned sand pit area is used as arenas for parties, paint ball wars, target shooting, and OHV riding (McGraw, 2004).

2.5.1.2 Data gaps

Part 1: Existing Conditions Report and Part II: Goals, Objectives, and Policies identified the following data gaps, which apply to the Olympia Watershed property in regard to recreational use:

1) The District has not marked or mapped trails authorized for use by SCCHA, nor has it revisited the terms of the agreement with the SCCHA requiring trail maintenance (Addressed by Resolution 34);

2) The District has not fully assessed the impacts to biotic resources from recreational use on District lands (Addressed by Resolution 34).

Since publication of Part I: Existing Conditions Report in 2009, the District has made significant progress in addressing these data gaps.

2.5.2 Key issues with respect to recreational use

According to McGraw (2004):

> One of the most important points that must be considered in managing recreation in the sandhills is that the unique geology, soil, and biology of the sandhills, combined with their rarity, renders them especially susceptible to degradation by recreational use. Land managers and policy makers experienced in recreation management in other systems are oftentimes unaware that sandhills communities can be greatly impacted by the same recreational use that would cause less of an impact to other systems (e.g. Redwood forest, Mixed Evergreen Forest). The inordinate impacts of recreation in the sandhills, when compared to other systems, are due primarily to three main factors: sandhills soils are fragile, sandhills species inhabit open areas where recreation occurs, and sandhills species and communities are extraordinarily rare. These same factors contribute to the differences in recreation impacts within sandhills habitat due to the heterogeneity of different communities.

Extensive trespass over the years has impacted the property's sensitive resources, primarily from OHV users, mountain biking, and equestrians, who have caused visible damage to endangered species habitat and boundary fencing. Some roads and trails eroded badly due to unauthorized

use. Key points of entry remained unimpeded by gates and fencing. The private security company hired to patrol watershed lands for trespass was unsuccessful.

Despite the many known negative impacts of active recreational use within the sandhills communities, passive low-impact recreation can provide increased public awareness and appreciation of this rare habitat. Restricted, low-impact outdoor recreation, such as docent-led hikes, provide a mechanism for many to experience the sandhills (McGraw, 2004) and may serve to increase support for the overall goals of conservation.

2.5.2.1 Resolution 34: Corrective action taken to address recreational impacts

The District held a public meeting in October 2010 to address recreational management issues by informing the community of the issues and soliciting public input to find appropriate solutions. The meeting brought to light the need to restrict recreational activities, as well as the need for additional fencing, signage, and blocking of access to protect the Olympia Watershed property. Public support was expressed for allowing only low-impact recreational activities, and for signage and "wildlife friendly" fencing.

On June 30, 2011 the District Board approved Resolution 34, which designates the extremely rare sand chaparral/sand parkland biotic communities on the property as "special protection areas" and prohibits all recreational uses except limited hiking, dog-walking and horseback riding on designated service roads. Resolution 34 further requires wildlife-friendly fencing to be installed at common access points and signs to be posted clearly indicating authorized uses.

Following Board approval of Resolution 34, District staff began implementing the following mandated actions:

1) Prohibit throughout the property all unauthorized motorized vehicle use, all bicycle use, poaching, alcohol use, firearms, smoking, use of fire, and camping. These activities are not an exclusive description, but are set out for purpose of illustration;

2) Restrict hiking, dog-walking, and equestrian use on the Olympia Watershed property to existing District service roads during daylight hours commencing 30 minutes after sunrise and ending 30 minutes before sunset;

3) Equestrian use is no longer restricted to members of the Santa Cruz County Horsemen's Association (SCCHA);

4) Require all dogs to be leashed; leashes shall not exceed ten feet in length;

5) Engage the services of an experienced land steward to patrol the Olympia Watershed property and discourage trespassers;

6) Fence and gate the western region of the property along the east side of the railroad tracks and both sides of the District service roads, as well as any other areas deemed necessary by the District to discourage trespass;

7) Post signs at appropriate intervals along fences, gates, and other known entry points, prohibiting trespass and listing recreational use restrictions;

8) Assess, on at least a six (6) month basis, or more frequently if deemed necessary, the success of implementing the aforementioned recreational use restrictions; the District retains the option of prohibiting all recreational use, if deemed necessary, in the final implementation plan for the property.

2.5.3 Recreational opportunities & constraints

Resolution 34 requires that recreational access be reviewed at least every six months to determine if the program is effective in protecting the resources at the Olympia Watershed property. Depending on assessment results, the District has the option of either continuing the limited recreational program or prohibiting all recreational use.

Opportunities

- Limited recreation may provide maximum benefit to the public, while reducing negative impacts to sandhills communities and species;
- Supervised public access to special protected areas, primarily scheduled docent-led hikes and volunteer service groups working on invasive species control project, could minimize impacts and enhance public education and awareness of the natural resources on the property;
- The use of motion-sensing security cameras could help identify trespassers, and thus reduce trespass and resulting damage;
- Limited recreation provides the opportunity for water resource interpretation and visitor education;
- With District participation in the appropriate permitting process, most recreation activities deemed appropriate by the District could be permitted.

Constraints

- Regulations governing endangered species (California and Federal Endangered Species Acts) and environmental impacts (California Environmental Quality Act) may limit the potential for authorizing recreational activities;
- Unauthorized recreational uses have caused erosion and damage to District lands, and impacted sensitive biotic resources, outcomes which are contrary to the District's primary and secondary goals;
- Recreational uses that require roads or trails may contribute to erosion and fine sediment.
- Limiting and enforcing authorized recreational uses would require more staff time and personnel costs, as well as fencing and signage costs;
- Greater public access could increase fire risk since wildfire ignition is highly correlated with public access.

2.5.4 Recreational alternatives

The District Board considered two management alternatives to address recreational use at the Olympia Watershed property, before approving Resolution 34:

Alternative 1: Prohibit all recreational access to the Olympia property; allow public access only for scientific, educational or natural resource management through the District permitting process.

Alternative 2: Prohibit all recreational uses at the Olympia Watershed property except limited hiking, dog-walking, and equestrian use on designated service roads only. Allow public access to other areas on the property only for educational, scientific, or natural resource management through the District's existing permit process

Discussion

Alternative 2 was selected by the Board as the better alternative. By excluding recreational uses from sensitive areas, at the same time, it gives recreational users the privilege to use and enjoy the property. In exchange, recreational users should establish a connection and sense of stewardship. Resolution 34 makes it clear that the Board can remove this privilege at any time, should recreational users abuse the privilege (Section 2.5.2.1).

2.5.5 Recreational recommended measures

All recreational activities recommended must meet the following additional secondary goal:

Secondary goal: *Continue existing compatible uses and provide opportunities for potential compatible uses on watershed lands, including educational, recreational, and scientific uses.*

The recommended measure is mandated by Resolution 34 in an attempt to correct past uncontrolled recreational uses at the Olympia Watershed property, which are incompatible with the primary and secondary goals of the District's watershed management plan.

REC-1: Prohibit all recreational uses at the Olympia Watershed property except limited hiking, dog-walking, and equestrian use on designated service roads only. Allow public access to other areas on the property only for educational, scientific, or natural resource management through the District's existing permit process (see ED-1).

Rec-1 Description

Implement all of the actions required by Resolution 34, and routinely monitor for success. If illegal trespass continues to impact natural resources, a more aggressive security plan with current available technology (cameras, sensors, etc...) and cooperation from concerned neighbors could be developed.

Rec-1 Costs

REC-1 incurs additional costs to the District to fence, sign, and patrol and enforce the program.

Fencing: Patrol and repair fencing as necessary; add fencing and gates as more entry points are found. Added fencing estimated at $8.00 per linear foot.

Signage: Signs to be posted at legal intervals along the fenced areas and at the gate indicating authorized uses and designated areas. Signage to include no trespassing notifications, the need to acquire a District permit to enter other areas of the property, a notification that endangered

species are on the property and that illegal entry could constitute a violation of the federal Endangered Species Act, etc. Cost estimated at $5,000.

Patrol: An experienced caretaker, who lives near the property, knows the area and the neighbors, has been contracted to patrol the District property on foot with a camera for approximately ten hours per week. The cost is approximately $15,000 per year. This person has used the same patrol strategy on the adjacent Morgan preserve in the past six months, and has greatly reduced impacts there.

Rec-1 Future Conditions

With controlled and limited recreational use of the property, a reduction in potential impacts to water quality and natural resources are expected, moving the District in the direction of achieving its management goals.

Rec-1 Monitoring

A patrol is in place to track and report the rate of unauthorized recreational use, and resulting impacts to the resources. As fencing and signage is completed, staff will compare the occurrence of illegal trespass to previous trespass levels and report to the Board every six months, as required by Resolution 34. The Board has the option of closing the property to all recreational use if illegal recreational use continues to impact the property.

2.6 Educational resources

In addition to meeting the District's primary watershed management goal, all educational recommended activities must meet the following additional secondary goals:

Secondary goal: *Continue existing compatible uses and provide opportunities for potential compatible uses on watershed lands, including educational, recreational, and scientific uses.*

Secondary goal: *Enhance public awareness of water quality, water supply, conservation, and watershed protection issues.*

2.6.1 Review of existing conditions re: Educational resources

The District has sponsored and supported research by government agencies and academic researchers on District land. Such research increases knowledge of sensitive species or habitat, including the sandhills and sand parkland communities and wildlife habitat on the Olympia watershed.

The District routinely grants permission to access the Olympia Watershed to researchers from the University of California, Santa Cruz, and to students from the San Lorenzo Valley High School's Watershed Institute.

The District has also worked closely with the Sandhills Alliance for Natural Diversity to research and protect the sandhills communities on District-owned lands.

Recently, the District authorized the Wildlands Restoration Team and the Santa Cruz County Resource Conservation District to access its watershed lands for the purpose of invasive species control and eradication.

Public outreach is needed to provide science-based interpretive education to the public, to help instill values of conservation.

2.6.1.1 Data Gaps

The District's Watershed Management Plan, Part I: Existing Conditions Report has acknowledged the following data gap related to educational resources, especially signage:

1. The District has not mapped and analyzed potentially hazardous areas on its lands, such as sites of toxics or hazardous wastes, dangerous cliffs, erosion-prone soils, mine shafts, pipelines, and overhead power lines (incomplete).

2.6.2 Key issues with respect to educational resources

The District's Education Grant Program provides funding on a competitive basis for educational projects that enhance the understanding of the San Lorenzo River Watershed environment or improve the watershed's environmental health. The District invites proposals from individuals, students, teachers, groups, and/or organizations for grant funding at levels set by the District Board. The program gives the highest priority to projects that exhibit some or all of the following features:

- Education programs for school age children and/or adults related to the watershed, water resources, water conservation and impacts on the environment;
- Educational outreach to all watershed residents and visitors to the area;
- Enhancement of the public's awareness of issues affecting water resources and water quality within the San Lorenzo River Watershed;
- A direct and positive impact on the San Lorenzo River Watershed.

The overlap between biotic resources research and education has resulted in the District Board awarding several Education Program Grants in 2010 and 2011 for projects that fill data gaps identified in the District's Watershed Management Plan, Part I: Existing Conditions Report. In 2011, the Education Program Commission recommended to the Board that in the future the District's watershed budget, rather than the Education Grant Program, be the source of funding for watershed research projects.

A second issue identified by the District's Public Relations Committee is the need for more interpretive signage and public outreach concerning the biotic and hydrologic resources at the Olympia Watershed property.

2.6.3 Educational opportunities & constraints

Opportunities

Education opportunities could be expanded to include some passive recreational access, such as docent-led hikes in special treatment areas.

The District could develop signage to educate the public about historical and cultural resources on the property, as well as potentially hazardous areas.

Constraints

Resolution 34 mandates continuance of the District permit process to allow access to sensitive areas at the Olympia Watershed for District-approved educational, scientific and natural resource management purposes.

2.6.4 Educational alternatives

Alternative 1: Develop a public outreach program to inform the public about special management issues facing the District; e.g., soil erosion, the impacts of illegal recreational use including increased ignition risk of wildfire and impacts to sensitive species.

Alternative 2: Develop and implement a "docent" volunteer Olympia Watershed enhancement program to supplement and support District staff in conducting environmental education programs, scientific research and restoration work. Emphasize school participation in watershed restoration projects.

Alternative 3: Develop and maintain a biotic resources monitoring database and make non-sensitive information accessible to the public for educational purposes.

Alternative 4: Develop signage to educate the public about cultural and historic resources as well as potentially hazardous areas on the property.

Alternative 5: Do nothing to change educational opportunities.

Discussion

Alternatives 1 - 4 support the District's Objective PA1-DL, to provide an educational outreach program to inform the public about the importance of protecting water quality and the purpose of the District's watershed lands, resource management practices, and water conservation. (Alternative 3 is the same as a recommended alternative for BIO-5.)

On the other hand, Alternative 5 does not fully support the secondary goal to *"Enhance public awareness of water quality, water supply, conservation, and watershed protection issues."* With no enhancement of public awareness in this area, a valuable human resource opportunity would be lost.

2.6.5 Educational recommended measures

The following measures are recommended to fulfill the selected educational alternatives:

ED-1: Continue the District's permit process to allow access to sensitive areas at the Olympia Watershed for District-approved educational, scientific and natural resource management purposes (mandated by Resolution 34).

ED-2: Develop public outreach program to inform the public about special management issues facing the District.

Subjects of particular importance at the Olympia Watershed property include soil erosion, the impacts of illegal recreational use, ignition risk of wildfire, impacts to sensitive species, cultural and historical resources, and potentially hazardous areas.

ED-3: Develop and implement a docent/volunteer Olympia Watershed enhancement program.

Explore the feasibility of developing a docent and/or restoration volunteer program to supplement and support District staff in conducting environmental education programs, scientific research and restoration work. Emphasize school participation in restoration projects.

ED-4: Incorporate interpretive information, on signs or by other appropriate means.

Place this information at the service road entrance to describe District management practices, interpret special watershed resources, or point out special management challenges (mandated by Resolution 34).

ED-5 (same as BIO-5): Maintain a monitoring database including photographs and documentation of projects for adaptive management purposes.

Maintain a digital monitoring database documenting baseline conditions, descriptions of projects, and monitoring data to assess performance of projects toward achieving desired outcomes. Make the database accessible to the public on the District website, with the exception that sensitive information be password-protected.

ED-1 thru ED-5 Cost

Only ED-2 and ED-3 will incur additional costs to the District, primarily in terms of staff time. Initial costs for ED-1 and ED-4 are already included in the budget. Small additional costs for ED-4 will be incurred for maintenance and replacement of signage. Costs for ED-5 are identical to costs for BIO-5.

ED-1 thru ED-5 Future Conditions

It is expected that educational outreach, docent programs and interpretive signage will result in more public support for protection of valuable biotic and hydrological resources at the Olympia Watershed property.

ED-1 thru ED-5 Monitoring

Follow-ups to the customer survey, which the District conducted in 2011, are expected to show an increased interest in District watershed management issues.

2.7 Cultural and historical resources

In addition to meeting the District's primary watershed management goal, all cultural and historical resources recommended activities must meet the following additional secondary goals:

> ***Secondary goal:*** *Continue existing compatible uses and provide opportunities for potential compatible uses on watershed lands, including educational, recreational, and scientific uses.*

Secondary goal: *Enhance public awareness of water quality, water supply, conservation, and watershed protection issues.*

2.7.1 Review of existing conditions: Cultural and historical resources

The Olympia Watershed property has a remarkable history. The sandy areas of the Olympia Watershed property that support the existing locally unique sandhills communities are part of the eroded remains of a much larger deposit of sandstone that probably covered much of central Santa Cruz County. Phillips (1990) concluded that the Santa Margarita sandstone formation was deposited approximately 9 to 12 million years ago, during the Miocene Epoch, in a tidal seaway that connected the Pacific Ocean with a vast inland sea in the San Joaquin Valley. The abundance of marine life that lived in this seaway is now represented by the many fossils of sand dollars, snails, and clam shells, as well as the teeth of sharks, seals, and other marine vertebrates that have been found in the Scotts Valley, Felton and Ben Lomond areas (Perry, 1977; McGraw, 2004).

The Olympia Watershed property was once populated by native people and is listed by the County of Santa Cruz as an archeological resource. (Information about archeological sites is confidential and is available only by request through the County of Santa Cruz.) Non-native settlers later planted vineyards and orchards at the site (RTD, 2009).

The sandy soils are visible evidence of the Santa Margarita Sandstone below, a geologic formation of loosely consolidated sands that is notable as an aquifer and a critical source of ground water tapped by two of the District's production wells. The sand at the site was found to be exceptionally well-suited for glass manufacturing and construction purposes. Hence, the Olympia Watershed property served as an active sand-mining operation in the 1900s.

Mining at the Olympia property for crushed rock, sand, and gravel began in 1937. From 1937 through the 1960s, these products were used for commercial construction and later, to build World War II projects. During this period, mining structures including retaining walls and concrete vaults were built. Mining equipment such as conveyor belts, a clarifier, settling ponds, and a railroad spur were also installed (RTD, 2009). A complete description of mining operations at the site is described by Hubbard (1943) as cited by RTD (2009). A summary follows.

From 1937 through 1943, sand production at the site "averaged well over 100,000 tons per year." Mining began by drilling 16-foot-deep holes where dynamite was blasted to loosen the sand. Loose material was then hoisted onto a 400-foot-long conveyor belt and moved to a storage hopper. Another conveyor belt moved the material from the storage hopper to the head chute where water was added and the material was screened. Material greater than 3/8" was wasted. Material from 3/8" down to 1/8" was sold as pea gravel. Material less than 1/8" was further processed and blended as different grades of commercial sand. A series of chutes and gates was used to sort, settle and wash the sand. Water used to wash the sand was drawn from "local surface water sources" (i.e.; Zayante Creek) at the rate of 600 gallons per minute. Wash water was reclaimed by a hydro-separator 50 ft. in diameter and 10 feet deep. The tailings from the hydro-separator were pumped into a series of four settling ponds where the water was treated with burnt lime (quick lime) and then released into Zayante Creek. A fifth settling pond was used

as a reserve for emergencies. According to the report, "In flood seasons, as when visited, these sand plants are permitted to release and clean out the accumulated tailing in all ponds" (Hubbard 1943).

These products were either trucked out to fill local orders or made via Southern Pacific Railroad in side-boarded flat cars, hoppers, and gondolas (Hubbard, 1943).

The Olympia sand pit operation was shut down before the California Surface Mining and Reclamation Act was enacted in 1975, but 1968 aerial photographs show that all of the mining equipment described above was in place (RTD, 2009). Much of the equipment has since been removed. The environmental site assessment did preliminary mapping (Figure 2-7) and photo documentation of remaining abandoned mining equipment. The report recommended that a complete site assessment accurately record the location of all site structures and abandoned quarry equipment (RTD, 2009). The report also recommended that all of the structures and equipment be dismantled and removed.

In 1977, after the mining operation closed, the District purchased 163 acres of the Olympia Watershed property for use as a well field. In 1981, the District drilled its first production well there.

In 2009, the District acquired another 17 acres on the western boundary of the Olympia Watershed property, and shortly afterwards, conducted an environmental site assessment which recommended removal of all abandoned structures and mining equipment on the property. The District removed several old metal sheds at the same time that it engaged in an invasive-species control project. When dense thickets of the invasive *acacia dealbata* trees were cut down and removed, more abandoned mining equipment, mostly half-buried cable, became visible. A discussion ensued as to whether or not the cable should be removed, given that the process could disturb the habitat of the endangered Mt. Hermon June beetle, which is known to nest under ground in the area.

For the history of recreational use on the property, see **Section 2.5 Recreational Use**. For a more general discussion of the history of recreational use throughout the Santa Cruz Sandhills, also refer to the Sandhills Conservation and Management Plan (McGraw, 2004).

Figure 2-7. Abandoned mining equipment and structures at Olympia Watershed property

2.7.1.1 Data Gaps

1. The District has not identified, mapped and assessed the significance of the cultural and historical resources on its watershed land. (Note: Partially completed for Olympia Watershed property. See Figure 2-7).

2.7.2 Cultural and historical resource management issues

While the environmental site assessment (RTD, 2009) recommends removal of all abandoned mining equipment on the property for safety and liability reasons, another argument has been made that some of this equipment should be retained on site because of its historical significance.

The wide distribution of half-buried industrial cable that became visible after the invasive acacia thickets were removed is clearly a safety hazard. Discussions with USFWS officials and sandhills experts have lent support to removing the cable despite potential impact of the removal process to the habitat of the endangered Mt. Hermon June beetle, which is known to nest in the area. These experts stated that the long-term benefit to the sandhills community of removing the cable would outweigh the potential short-term impact.

The data gap in paragraph 2.7.1.1 points out the need for the District to know where paleontological and archeological resources are on the property, in order to protect them.

2.7.3 Cultural/historical opportunities & constraints

Opportunities

- Removal of some or all remaining abandoned mining equipment, especially half-buried cable, would reduce safety hazards on the property;
- More complete assessment of remaining mining equipment could identify some pieces that have historical value which outweigh the safety hazard potential;
- A more complete description of paleontological and archeological artifacts on the property would provide benefit to the District in planning future projects.

Constraints

- Removal of half-buried cable would require the use of heavy equipment and disturbance of the soil where endangered species reside;
- Abandoned mining equipment left on site could appear as slovenly land management, unless appropriate documentation and interpretive signage were on site to explain its value;
- Publication of documentation of paleontological and archeological information could result in theft and vandalism.

2.7.4 Cultural/historical management alternatives

Alternative 1: Remove all abandoned mining equipment on site;

Alternative 2: Research and document remaining mining equipment, selecting a sampling of those with historical value for retention on site with appropriate interpretive signage;

Alternative 3: Research and document sites of paleontological and archeological value and maintain confidentially in District files;

Alternative 4: Leave site as it is and do no further research to document paleontological and archeological resources.

Discussion

Alternative 1 is recommended by the environmental site assessment report (RTD, 2009) for safety and liability reasons, but without further documentation, such an action risks destroying some artifacts of historical significance. This would run counter to the District's Objective CH1-DL, which is to "Identify the locations and document the significance of cultural and historical resources on District watershed lands," as well as Objective CH2-DL, which is to "Develop policies, as appropriate, to protect historical and cultural resources, on District lands, as they are identified."

Alternative 2 is more in keeping with Objectives CH1-DL and CH2-DL, because it requires more research to determine which artifacts might have historic and cultural value, while allowing other materials to be removed for safety reasons.

Alternative 3 is required by Objective CH1-DL. This information would be kept confidential in order to protect the resources, but it would be valuable in informing the District's plans for future projects.

Alternative 4 does not support Objectives CH1-DL and CH2-DL. Without proper documentation of these resources, the District would not have the information it needs to assess potential impacts to the resources in future projects.

2.7.5 Cultural/historical recommended measures

CH-1: Research and document abandoned mining equipment remaining on site, select those with historical value for retention on site with appropriate interpretive signage, and remove the remainder.

CH-1 Cost

CH-1 will incur additional costs to the District, in terms of staff time, and alternatively, to hire a consultant. Additional costs will be incurred for interpretive signage. Fencing and signage already installed to protect endangered species habitat will help to address liability issues presented by abandoned mining equipment.

CH-1 Future Conditions

It is expected that documentation and interpretive signage explaining the cultural and historical significance of these artifacts will result in more public support for protection of these resources at the Olympia Watershed property.

CH-1 Monitoring

Follow-ups to the customer survey, which the District conducted in 2011, are expected to show an increased interest in the District's cultural and historical resources.

CH-2 Research and document sites of paleontological and archeological value and maintain confidentially in District files

CH-2 Cost

CH-1 will incur additional costs to the District, in terms of staff time, and alternatively, to hire a consultant.

CH-2 Future Conditions

Documentation of paleontological and archeological artifacts could help inform planning and siting of any future District projects on the property.

CH-2 Monitoring

None.

2.8 Climate change

In addition to meeting the District's primary watershed management goal, all climate change recommended activities must meet the following secondary goal:

> **Secondary goal**: *Consider climate change impacts and reduction of greenhouse gases in all watershed management decisions.*

2.8.1 Review of existing conditions re: Climate change

This section begins with an update to the District's 2009 Existing Conditions Report discussion on climate change. Table 2-4 lists the terms and abbreviations used in this discussion.

Table 2-4. Climate change terms and abbreviations used in this section

Term	Abbreviation
California Assembly Bill 32: California Global Warming Solutions Act	AB32
Climate Action Registry	CAR
California Air Resources Board	CARB
Community Choice Aggregation	CCA
California Environmental Quality Act	CEQA
California Department of Water Resources	DWR
Greenhouse gases	GHGs
Intergovernmental Panel on Climate Change	IPCC
Integrated Regional Water Management	IRWM
Integrated Regional Water Management Plan	IRWMP

Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide, known as greenhouse gases (GHG), have increased markedly as a result of human activities, especially fossil fuel burning and deforestation since 1750.

With virtual certainty, scientists serving on the Intergovernmental Panel of Climate Change (IPCC) have projected for this century that there will very likely be more warm spells and heat waves, more heavy precipitation events, and a global mean sea level rise of 0.2 to 0.8 meters or more by 2100 (IPCC, 2007). These impacts are predicted to occur during this timeframe, despite the best international efforts to curb GHGs. Nonetheless, reductions in present levels of GHGs emissions are critically needed to reverse the warming trend and its impacts on future generations.

The IPCC (2007) projects an average global warming of about 0.2 degrees C per decade for the next two decades. Winters will be drier in all regions, with a slightly shorter wet season. The total amount of water in the state is predicted to decrease, water needs to increase, and the timing of water availability to be greatly perturbed.

These changes in temperature and precipitation are predicted to change vegetation patterns in watersheds and recharge areas.

The two approaches to address climate change are known as *mitigation* and *adaptation*.

Mitigation seeks to reverse climate change impacts by reducing the amount of greenhouse gases in the atmosphere through reduction of fossil fuel burning, and through increasing the amount of carbon stored in forests and the ocean. Mitigation efforts, though critical, are not expected to show results for many decades.

Adaptation seeks to prepare the world for the widespread changes that climate change will bring, understanding that no matter how successful mitigation efforts are, changes such as sea level rise and weather patterns are inevitable. Adaptation efforts are especially critical in terms of water use and management.

2.8.1.1 Mitigation

California Assembly Bill 32 (AB 32) is the first law to comprehensively limit greenhouse gas (GHG) emissions at the state level. AB 32 became law in 2007. AB 32 establishes annual reporting of GHG emissions for significant sources and sets emission limits to cut the state's GHG emissions to 1990 levels by 2020.

The California Air Resources Board (CARB) is developing the state's mandatory reporting program for companies/government agencies by sector. The water sector reporting protocols have not been completed to date.

In October 2011, CARB adopted the state's final cap and trade regulation, which joins a suite of other major measures including standards for ultra-clean cars, low-carbon fuels and renewable electricity. The cap and trade regulation sets a statewide limit on sources responsible for 85 percent of California's greenhouse gas emissions and provides organizations with the flexibility to seek out and implement the lowest-cost options to reduce emissions.

Mandatory reporting of emissions will begin by phasing in major industrial sources and electricity utilities in 2013, followed by fuel distributors in 2015.

In 2013 and 2014, the state will issue emitters allowances based on their current emissions, but as the cap on emissions declines each year, the total number of allowances issued in the state

drops, requiring companies to find the most efficient approaches to reducing their emissions. Industrial sources that need additional allowances to cover their emissions can purchase them at regular quarterly auctions, which CARB will conduct, or buy them on the market. The first auctions, for 2013 allowances, are slated for August and November 2012.

Organizations that reduce their emissions so that they have left over allowances can sell those allowances to organizations that need extra allowances. The state will lower the caps on emissions every year so that by 2020, statewide emissions will be reduced to 1990-levels, as required under AB 32.

To complement AB-32's mandate to reduce greenhouse gas emissions, CARB is developing protocols for forest landowners to provide an incentive to accelerate the current rate of carbon storage or sequestration by forests and other natural areas. All plants pull carbon from the atmosphere as part of the process of photosynthesis. Studies have shown that older forests store and continue to sequester more carbon than young forests in both trees and the soil (Krankina and Harmon, 2006). Coastal redwoods sequester more carbon than any other tree species. While forests store enormous amounts of carbon, they also have the potential to emit carbon when they are harvested, burned, and as they decay (Krankina and Harmon, 2006). CARB protocols for forest landowners aim to incentivize management actions away from "business as usual," to a regime that reduces the rate of carbon emission. These protocols are planned for final review in 2013. Qualifying landowners who have inventoried the carbon stored by their forests will then be able to sell carbon credits under the cap and trade program to organizations whose greenhouse gas emissions exceed their allowances. The District owns approximately 1,500 acres of forest land, which, once inventoried, should qualify the District to sell carbon credits under the cap-and-trade program.

The California Department of Water Resources (DWR) recommends that water and wastewater utilities conduct an assessment of their carbon footprint and implement strategies as described in the draft AB 32 Scoping Plan to reduce greenhouse gas emissions. Utilities are further advised to join the Climate Action Registry (CAR) to ensure accurate calculation of greenhouse gas emissions. The District has inventoried its greenhouse gas emissions annually since 2006, and is a member of CAR.

2.8.1.2 Adaptation

DWR has identified several regional strategies to address climate change adaptation (DWR, 2008). These strategies include development of Integrated Regional Water Management (IRWM) planning. IRWM is a comprehensive approach for determining the appropriate mix of water demand, supply, and water quality actions. It seeks reliable water supplies at the lowest reasonable cost and with highest economic and environmental benefits. Each regional IRWM plan should address the following elements:

- Coordination of local groundwater storage and banking with local surface storage and other water supplies;
- Regional assessment of vulnerability to long-term increased risk and uncertainty associated with climate change;
- An integrated flood management component;

- A drought component that assumes a 20 percent increase in the frequency and duration of future dry conditions;
- Aggressive conservation and efficiency strategies;
- Integration with land use policies that help restore natural processes in watersheds to increase infiltration, slow runoff, improve water quality and augment natural storage of water;
- Encourage low-impact development that reduces water demand, captures and reuses stormwater and urban runoff, and increases water supply reliability;
- Sharing of water supplies and infrastructure during emergencies such as droughts.

The County of Santa Cruz Division of Water Resources is leading IRWM planning for this region, and the District is involved in planning efforts. The District is an active member of the Santa Margarita Ground Water Advisory Committee, where IRWM planning efforts are frequently discussed.

2.8.2 Climate change management issues related to the Olympia Watershed

The Olympia Watershed property plays an important role in how the District addresses climate change, both in terms of mitigation and adaptation. The District Board approved Resolution 2, "Climate Change and Water Resource Management" in September 2008, committing the District both to mitigation and adaptation efforts.

2.8.2.1 Mitigation

The District has adopted two planning objectives with regards to mitigation of climate change on its own lands. The first is: **CC3-DL Reduce the District's greenhouse gas emissions.** The second is: **CC4-DL Increase carbon sequestration on District watershed lands.**

The District has inventoried its GHGs for five years, and has identified the District's major GHGs sources. The two Olympia Watershed production wells consume more electricity and, thus, emit more greenhouse gases than any other component of the District's water system. Since energy use by well pumping increases during dry years and since climate change is expected to deliver longer dry spells, the District could see its greenhouse gas emissions going up rather than coming down. To complicate matters, the District's electric power supplier is PG & E, whose energy portfolio may vary considerably from one year to the next with differing mixes of alternative/fossil fuel energy sources. Selection of this energy portfolio is beyond the District's control. The District completed major solar panel installations at Lyon and Felton in 2011, which has significantly reduced GHGs emitted by the water-treatment process.

The following actions offer additional ways to address reduction of GHGs:

- Installation of solar panels at the Olympia watershed property. This action could significantly reduce GHGs from fossil fuels. However, selection of sites to avoid impacts to endangered species may be challenging, but the project could likely be accomplished by mitigating impacts through the habitat conservation planning process.

- County establishment of a regional Community Choice Aggregation (CCA). CCAs were established by the California legislature in 2002 (AB 117) to give cities and counties the authority to procure electricity on behalf of customers within their jurisdictions. Under a CCA program, PG&E would deliver the electricity to end-use customers and PG&E would

continue to read the electric meters and bill customers. Unlike traditional utility service, the source of the electric supply (generation) and the price paid by customers for the generation services procured by the CCA program would be determined by member communities. Customers would have the choice of being automatically enrolled in the program or remaining with PG&E. Several counties including Marin have implemented CCAs. The Santa Cruz County and Monterey County Boards of Supervisors authorized in 2011 a joint feasibility study to determine the advantages and disadvantages of a CCA in the Monterey Bay Region.

- Water conservation. The District's existing water conservation program, as well as participation in the inter-agency Water Conservation Coalition, helps to reduce GHGs because as water is conserved, less water has to be treated and distributed, and less energy is consumed.

With regards to increasing carbon sequestration on District lands, the District manages its forest land at Olympia Watershed as well as all its forest lands toward late seral stage, which increases the volume of carbon stored.

The following action would help defray the costs of the District's GHG emission program:

- Marketing of carbon credits from District forest land. Whenever the State's AB32 cap-and-trade program is implemented, the District could sell carbon credits to help defray the costs of its GHG reduction efforts. To qualify, the District must inventory the carbon stored in its forests, verify the results, and certify through the Climate Action Registry. A cost of $40,000 is estimated for this process. Since carbon credits would be sold at market price, there is no way to predict how much the credits would sell for, at least until the cap-and-trade program is underway and a market price is set.

2.8.2.2 Adaptation

The District has adopted two planning objectives with regards to adaptation to climate change on its own lands. The first is: CC1-DL Develop a long-term watershed management strategy that takes into account possible large-scale changes from global climate change.

The second is: CC2-DL Endeavor to make the ecosystems on District lands as healthy and resilient as possible to maintain fundamental natural functions and processes in the face of unknown impacts of climate change.

To address CC1-DL, the District is working with the County and other public water agencies to address water supply issues that will be exacerbated by climate change. Efforts include participation in the county's IRWMP, the Santa Margarita Groundwater Committee, and emergency preparedness from extreme weather from climate change; power outages, generators.

To address CC2-DL, the District has implemented several projects that are aimed at increasing the health and resiliency of the Olympia Watershed, including the identification and fencing of special protection areas for sandhills communities, the prohibition of recreational activities in those areas, and continuing efforts to control and eradicate invasive plant species from the

property. Managing forest land to late seral stage enhances the ecosystem health of the forest, making it more resilient to the impacts of climate change.

The District's existing emergency preparedness program is likely to be implemented more frequently to address extreme weather conditions resulting from climate change, such as power outages.

2.8.3 Climate change opportunities & constraints

Opportunities

- Solar panel installations at Olympia Watershed could significantly reduce GHGs emitted from electric power usage by production wells;
- By participating in the habitat conservation plan process, the District could receive a permit for solar panel installation in exchange for on-site habitat preservation and management, much of which the District prescribing in this management plan;
- Formation of a local CCA and District membership in the CCA could give the District more control over its electrical power portfolio, increase the use of alternative energy sources, and reduce District GHGs;
- Continuing or enhancing water conservation efforts will help reduce District GHGs;
- Inventorying carbon stored in District forest lands, and selling credits through the AB32 cap and trade program could help reduce the costs of the District's GHG reduction efforts;
- Participation in the County's IRWMP could better secure water supplies during times of scarcity caused by climate change, and help secure grant money to fund water projects;
- Review of District's Emergency Preparedness system could ensure better response to climate change impacts.

Constraints

- Endangered species habitat at Olympia Watershed would likely increase the expense of a solar panel installation project, since it would require participation in the habitat conservation planning process;
- Formation of a local CCA could take several years and the disadvantages and advantages will not be well known until the feasibility study is complete;
- Increased water conservation reduces District revenue;
- Delays in state approval of the forestry protocol mean that marketing of carbon credits from District forest land will be further delayed, with the market value of carbon credits remaining unknown;
- The IRWMP has been in the works for many years, and it is unknown when funds will be available for needed water projects such as conjunctive water use;
- CEQA requires analysis of greenhouse gas emissions for every proposed project.

2.8.4 Climate change management alternatives

The following management alternatives address climate change management issues:

Alternative 1: Explore options for installation of solar panels;

Alternative 2: Increase District-wide efforts to conserve water;

Alternative 3: Inventory carbon storage on District forest lands to prepare for marketing of carbon credits in upcoming state cap-and-trade program;

Alternative 4: Participate in CCA feasibility study;

Alternative 5: Continue participating in IRWM planning;

Alternative 6: Review District Emergency Preparedness Plan for anticipated climate change impacts;

Alternative 7: Continue managing sandhills areas as "special protection zones;"

Alternative 8: Continue managing upland redwood and mixed evergreen forests toward late seral stage.

Discussion

Alternatives 1 – 4 address *climate change mitigation*. The potential GHG emissions reduction from installing solar panels at the Olympia Watershed property warrants further examination to determine the feasibility of siting solar panels within endangered species habitat. Increased water conservation efforts will further reduce the energy needs of the District, but the resulting reduction in water-sales revenue makes it essential for the District to seek other sources of revenue. Income from marketing of carbon credits could provide a source of revenue when the state's cap-and-trade system is implemented. To qualify to sell carbon credits, the District must inventory the carbon stored in its forests. Forest growth simulation models enable the District to project inventories forward until such time as carbon credits can be sold. A local CCA, such as the one implemented in Marin County, could provide the District with more control over its electric-energy portfolio, thus reducing GHG emissions from electrical use. Participation in the county's CCA feasibility study would help the District determine whether a CCA would provide a benefit in terms of GHG reduction, and in terms of cost.

Alternatives 5 – 8 address *climate change adaptation*. Participation in IRWM Planning could help identify projects relative to climate change adaptation that may be eligible for state funding. Review by staff of the District's Emergency Preparedness plan to specifically include expected climate change impacts is warranted. The District's continuing efforts to control illegal recreational use and invasive plant species and to manage forests toward late seral stage at the Olympia Watershed property are improving ecosystem health and resilience to climate change.

2.8.5 Climate change recommended measures

CC-1: Explore feasibility of installing solar panels at the Olympia Watershed

Continue exploring "Phase 2" of the District's planning process for solar installations. Determine feasibility of locating solar panels at Olympia Watershed, considering potential impacts to endangered species.

CC-1 Cost

In October 2010, staff estimated the costs of environmental review, permitting, mitigation and monitoring of Phase 2 at ~$183,000. Costs of implementation to be determined (TBD).

CC-1 Future Conditions

TBD

CC-1 Monitoring

TBD

CC-2: Increase District-wide efforts to conserve water

CC-2 Cost

TBD. The District will lose sales revenue from water that is conserved. Rebates for water-saving devices also incur costs.

CC-2 Future Conditions

TBD

CC-2 Monitoring

TBD

CC-3: Inventory carbon storage on District forest lands to prepare for marketing of carbon credits

CC-3 Cost

In June 2010, staff received an estimate of ~$45,000 to inventory, model and manage the carbon storage inventory project through registration with the Climate Action Registry. District forest lands included in the project total 1,700 acres including 180 acres at the Olympia Watershed.

CC-3 Future Conditions

Future carbon storage to be projected by modeling based on baseline inventory.

CC-3 Monitoring

TBD

CC-4: Participate in county Community Choice Aggregation feasibility study

CC-4 Cost

Staff time and travel to attend meetings.

CC-4 Future Conditions

TBD

CC-4 Monitoring

None.

CC-5: Continue District participation in County IRWM planning

CC-5 Cost

Staff time and travel.

CC-5 Future Conditions

TBD

CC-5 Monitoring

None.

CC-6: Review District Emergency Preparedness Plan in anticipation of climate change impacts

CC-6 Cost

Staff time plus undetermined costs for potential upgrades.

CC-6 Future Conditions

TBD

CC-6 Monitoring

TBD

CC-7: (same as BIO-2 and FIRE-3) Continue managing sandhills areas as "special protection zones"

CC-7 Cost

Budgeted.

CC-7 Future Conditions

Same as BIO-2

CC-7 Monitoring

Same as BIO-2

CC-8: (same as BIO-3 and FIRE-1) Continue managing uplands forests toward late seral stage

CC-8 Cost

Budgeted.

CC-8 Future Conditions

Same as BIO-3.

CC-8 Monitoring

Same as BIO-3.

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Appendix A: Summary of selected management alternatives & recommended measures

Category	Management issue	Selected management alternative(s)	Recommended management measures
Hydrology, geomorphology and water quality	Erosion/impacts to water quality	Map and assess known erosion-prone areas and re-assess as management actions are considered	HYDRO-1 Map and assess known erosion-prone soils and re-assess on a project-by-project basis
	Erosion/impacts to water quality; protection of recharge	Minimize road/trail related sediment sources and stabilize a set of roads/trails deemed essential to provide restricted access for maintenance of District infrastructure, access for fire fighting, and access for environmental enhancement work	HYDRO-2: Reduce erosion, pollution, and compaction from roads/trails
	Impacts to water quality; public safety	Survey and record the locations of all site structures and abandoned quarry equipment; dismantle and remove old site structures and abandoned equipment, sample and analyze soils for contamination.	HYDRO-3: Locate and remove old quarrying debris, and test soils beneath for potential contamination
	Water quality impacts	Reduce volume of trench-line spoils and construction debris stored on site by adhering to best management practices during construction activities that produce the spoils.	HYDRO-4: Reduce volume of trench-line spoils and construction debris stored on site

Category	Management issue	Selected management alternative(s)	Recommended management measures
Biotic resources	Identification and documentation of sensitive species on the property	Collect biotic resources data to address data gaps, identified in the Existing Conditions Report, and applicable to the Olympia Watershed property	BIO-1: Prioritize and address remaining data gaps applicable to biotic resources on the Olympia Watershed property
	Protection and enhancement of sensitive species	Actively manage through restriction to public access, control of invasive species, and restoration to improve conditions for native plant and wildlife populations	BIO-2: Designate sand chaparral/sand parkland biotic communities as "special protection areas" requiring active management.
	Forest management for protection of water quality	Areas where ecological processes are already moving toward late seral stage would require monitoring but no active management. Areas currently in a degraded state would be actively managed through enhancement projects to move the system toward old-growth.	BIO-3: Continue managing upland mixed evergreen forests toward late seral stage
	Observed long-term poaching of native reptiles on the property	Active management of physical habitat to improve conditions for native wildlife populations	BIO-4: Improve protection of native reptiles from poaching
	Need to determine success of projects aimed at improving biotic conditions	Data collection, active and passive management	BIO-5 Maintain a monitoring database including photographs and documentation of projects for adaptive management purposes.
Fire management	Forest management for fire resistance	Allow old-growth stands to develop naturally over time, while actively controlling exotic, invasive plant species & manually removing ladder fuels, as needed	FIRE-1 (BIO-3): Continue managing upland mixed evergreen forests toward late seral stage

Category	Management issue	Selected management alternative(s)	Recommended management measures
	Control of fire spread	Prevent fire from spreading to or from surrounding areas; shaded fuel breaks to border existing roads, where possible	FIRE-2 Develop shaded fuel breaks
	Restriction of controlled burns in residential areas	Commit to long-term, active control of invasive exotic plant species using appropriate techniques excluding controlled burning, and monitor success of repopulation by native species; Limit public access in sandhills/sand parkland areas to decrease the spread of invasive plant seed.	FIRE-3 (BIO-2): Designate sand chaparral/sand parkland biotic communities as a "special protection area" requiring active management.
	Ignition sources not controlled	Restriction of recreational uses on property	FIRE-4 (REC-1) Reduce ignition sources
	Post-fire management measures to protect ground water sources	Prepare for occurrence of fire on District property	FIRE-5: Develop a comprehensive plan to prepare for the occurrence of fire
Recreation	Restriction of recreation to protect biotic & hydrologic resources and reduce fire risk	Only limited and controlled recreational uses allowed on service roads only.	REC-1: Prohibit all recreational uses at the Olympia Watershed property except limited hiking, dog-walking, and equestrian use on designated service roads only. Allow public access to other areas on the property only for educational, scientific or natural resource management through he District's existing permit process.

Category	Management issue	Selected management alternative(s)	Recommended management measures
Education	Need for increased public awareness of issues affecting water resources and water quality	Support District staff in conducting environmental education programs, scientific research and restoration work.	ED-1: Continue the District's permit process to allow access to sensitive areas at the Olympia Watershed for District-approved educational, scientific and natural resource management purposes.
	Need for increased public awareness of issues affecting water resources and water quality	Develop public outreach program to inform the public about special watershed management issues facing the District	ED-2: Develop public outreach program to inform the public about special watershed management issues facing the District
	Need to instill values of conservation; Need for increased public awareness of issues affecting water resources and water quality	Develop and implement a "docent" volunteer Olympia Watershed enhancement program to supplement and support District staff in conducting environmental education programs, scientific research and restoration work. Emphasize school participation in watershed restoration projects.	ED-3: Develop and implement a volunteer Olympia Watershed enhancement program
	Need to instill values of conservation; Public safety	Develop signage to educate the public about biotic, cultural and historic resources as well as potentially hazardous areas on the property.	ED-4: Incorporate interpretive information on signs or by other appropriate means
	Need to instill values of conservation; Need for increased public awareness of issues affecting water resources and water quality	Develop and maintain a biotic resources monitoring database and make non-sensitive information accessible to the public for educational purposes.	ED-5 (BIO-5): Maintain a monitoring database including photographs and documentation of projects for adaptive management purposes.

Category	Management issue	Selected management alternative(s)	Recommended management measures
Cultural/Historical	Safety and liability of old equipment on property; need to retain historic sample	Research and document abandoned mining equipment remaining on site, and select those with historical value for retention on site with appropriate interpretive signage.	CH-1: Research and document abandoned mining equipment remaining on site, and select those with historical value for retention on site with appropriate interpretive signage.
	Need to document historic resources in order to protect them	Research and document sites of paleontological and archeological value and maintain confidentially in District files	CH-2: Research and document sites of paleontological and archeological value, and maintain confidentially in District files
Climate Change	Reduce District greenhouse gas emissions	Explore options for installation of solar panels	CC-1: Explore feasibility of installing solar panels at the Olympia Watershed
	Reduce District greenhouse gas emissions	Increase District-wide efforts to conserve water	CC-2: Increase District-wide efforts to conserve water
	Reduce District greenhouse gas emissions	Inventory carbon storage on District forest lands to prepare for marketing of carbon credits	CC-3: Inventory carbon storage on District forest lands to prepare for marketing of carbon credits
	Reduce District greenhouse gas emissions	Participate in county Community Choice Aggregation feasibility study	CC-4: Participate in county Community Choice Aggregation feasibility study
	Prepare for impacts of climate change	Continue District participation in County IRWM planning	CC-5: Continue District participation in County IRWM planning
	Prepare for impacts of climate change	Review District emergency preparedness plan in anticipation of climate change impacts	CC-6: Review District emergency preparedness plan in anticipation of climate change impacts
	Prepare for impacts of climate change	Continue managing sandhills areas as “special protection zones”	CC-7 (BIO-2 & FIRE-3): Continue managing sandhills areas as “special protection zones”
	Prepare for impacts of climate change	Continue managing uplands forests toward late seral stage	CC-8 (BIO3 & FIRE-1): Continue managing uplands forests toward late seral stage