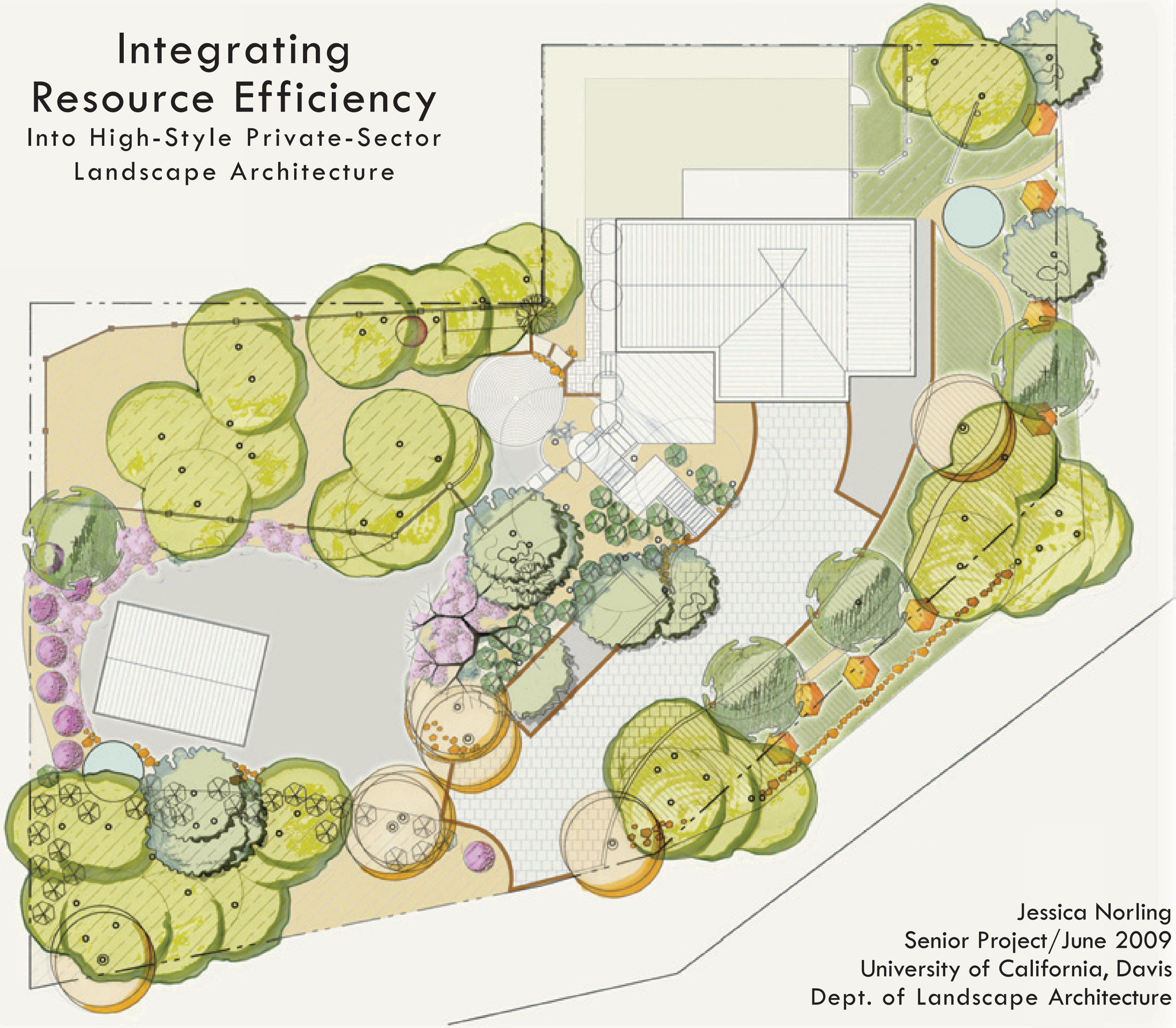
Integrating Resource Efficiency

Into High-Style Private-Sector Landscape Architecture



Jessica Norling
Senior Project/June 2009
University of California, Davis
Dept. of Landscape Architecture

Integrating Resource Efficiency

Into High-Style Private-Sector Landscape Architecture

Jessica Norling
Senior Project/June 2009
University of California, Davis
Dept. of Landscape Architecture

Integrating Resource Efficiency

Into High-Style Private-Sector Landscape Architecture

A Senior Project
Presented to the Faculty of the
Landscape Architecture Department
University of California, Davis
in Fulfillment of the Requirement for
the Degree of Bachelors of Science of
Landscape Architecture

Presented by:

Jessica Norling
at the
University of California, Davis
on
June 12th, 2009

____
Mark Francis, Senior Project Advisor

____
Jeff Loux, Committee Member

____
Byron McCulley, Committee Member

____
Victor Norling, Committee Member

Abstract

The purpose of this project is to prepare a master plan for a private residence in the Coast Range Mountains of Central California working within the framework of Bioregional design theory. Bioregionalism is a holistic design approach that operates at all levels of land planning from the private residence to large scale community developments, parks or institutions, as detailed by Ian McHarg in his 1969 book, *Design with Nature*. In this approach the designer achieves solutions to site-specific requirements through finding ways of integrating with the surrounding ecological systems. The goal is to design a private landscape that is in keeping with the rich ecological and cultural heritage unique to this region.

Through the cyclical and self-reflective design approach described in Zeisel's book, *Inquiry by Design*, data collected in the research and site analysis phases of the study was incorporated into an evolving and comprehensive design program. Drawing upon sources of expertise in the various fields of history and culture, physical and biological sciences, and bioregional design methodologies, a design concept for the site began to emerge. It is this process of developing knowledge of the many layers of background information of a site that the designer becomes best-equipped to work in a methodology that accommodates nature throughout all phases of planning and development.

The results of this study show the potential for integrating a particular site design within the larger natural and cultural framework of the region through careful background research and thoughtful planning. Also, at a resource-specific level, it is my belief that the potential for improvements in water conservation have only just begun to gain popular support at all scales of development. With a thorough understanding of the conditions of a site, techniques such as, grouping plants by water requirements (hydrozoning), adapting dual-valve rainwater harvesting to drip-irrigation systems, and designing with native plants will have calculable effects on reduced energy and financial inputs over the long-term.

Dedication

This project is dedicated to Victor C. Norling and Thierry Tondusson who have both been there to lend a hand when life presented me with things that were too heavy to lift on my own. I would never have been able to do this without you...

And to all of the people I've known, past, present and future who have given meaning to my life through their honesty and authenticity - to me the great mark of humanity.

Acknowledgements

I would like to thank my committee members Byron McCulley, Jeff Loux and Victor C. Norling for their generous time and guidance with this and other works over the past six months.

Michael Rios, thank you for letting me into your class at the last minute which allowed me to catapult forward through the program, and for your sincerity and inspiration ever since then.

Thank you to Elizabeth Boults for your excellent class on the history of landscape architecture, it could not have been more interesting and rewarding.

Thank you to Steve McNiel for lighting a flame of inspiration in every possible way.

And to Heath Schenker for offering me the challenge to expand my artistic sensibilities, and to learn to see the world in a whole new way.

Table of Contents

Title Page
Abstract
Acknowledgements.........iii
Table of Contents.........iv
List of Illustrations.........v
Preface.........vii
Introduction......... 1
Regional Context.........3
Location Map.........3
Land-Uses & Ownership.........4
Zoning & Restrictions......... 8
Assessor's Parcel Map.........9
Ecology......... 10
Geology......... 10
Climate......... 12
Vegetation.........13
Wildlife......... 15
Cultural History......... 17
The Ohlone.........17
Spanish Settlement and Mexican Land Grants 19
Lumbering to the Presnt.........20
Site Analysis......... 24
Existing Conditions.........24
Topographical Survey & Site Measurements......... 25
Slope Analysis......... 26
Hydrozones......... 27
Program Development.........28
Program Goals......... 28
Water Use Study......... 29
WUCOLS EAWU.........30
Rainwater Harvesting.........31
Design Development.........32
Functional Diagram......... 33
Master Plan.........34
3-D Model.........35
Irrigation Plan.........41
Planting Plan.........43
Designing with Local Materials......... 50
Conclusion.........53
Bibliography.........54

List of Illustrations

1.1 Location Map: San Mateo County, California.................. 3
1.2. The Peninsula Watershed.. 4
1.3 Crystal Springs Reservoir.. 5
1.4 Crystal Springs Dam.. 5
1.5 Midpeninsula Regional Open Space Preserve................. 6
1.6 Purissima Creek Watershed... 6
1.7 Purissima Creek Open Space Preserve............................. 7
1.8 San Mateo County Zoning Map... 8
1.9 Resource Management/Timber Preserve Zoning............ 9
1.10 Parcel Map.. 9
2.1 Geology of the Coast Ranges... 11
2.2 Precipitation in the Santa Cruz Mountains......................... 12
2.3 Sequoia sempervirens in the fog....................................... 13
2.4 Seasonal Creeks.. 14
2.5a Wildlife Native to the Region... 15
2.5b Wildlife, continued.. 16
3.1 Cover Illustration of *The Ohlone Way*............................... 17
3.2 Ohlone Village.. 18
3.3 Ohlone Dwelling and Tools 18
3.4 Spanish Mission..19
3.5 The Woodside Store.. 20
3.6 The Summit Springs Hotel...21
3.7 Old-growth Redwoods...20
3.8 A Twelve-Ox Team..20
3.9 Old-grwoth Redwoods... 21
3.10 The Sons of Norway Clubhouse.. 22
3.11 Al Knudson's House..22
3.12 Old-growth Redwoods...22
3.13 The Inversion Layer...23
4.1 Site Analysis...24
4.2 Survey of Topography...25
4.3 Slope Analysis.. 26
4.4 Hydrozones.. 27
5.1 Current Outdoor Water Use.. 29
6.1 Bubble Diagram... 33
6.2 Master Plan.. 34
6.3a Creating a TIN... 35
6.3b Creating a TIN..35
6.3c Creating a TIN..35

6.4a Draping the Base Map.. 36
6.4b Draping the Base Map.. 36
6.4c Draping the Base Map..36
6.5 Rendering in SketchUp..37
6.5b Rendering in PhotoShop.. 38
6.6 Perspectives... 39
6.7 Close-Up View...40
6.8 Diagram of Rainwater Catchment System.........................41
6.9 First Flush Diverters...41
6.10 Irrigation Plan..42
6.11 Planting Plan A...44
6.12 Sun-loving Pollinator Garden..45
6.13 Planting Plan B... 46
6.14 Shade-loving Wildflower Meadow....................................47
7.1 Cobblestone Pavers..49
7.2 Local Installation of Pavers... 49
7.3 Recycled Content Bricks...49
7.4 Paving Patterns.. 49
7.5 Installation Diagram..49
7.6 Sculpture by John Lamos.. 49
7.7 Salvaged Old-growth Redwood....................................... 50
7.8 Stone Veneer... 50
7.9 Dry-stacked Stone Wall...50
7.10a Examples of California Native Stone............................ 50
7.10b Examples of California Stone...50
7.10c Examples of California Stone.. 50
7.11 25,000 Gallon Storage Cistern..51
7.12 10,000 Gallon Storage Cistern..51
7.13 Table of Storage Capacities...51

Preface

The site for this project is located along the crest of the northernmost Santa Cruz Mountains (part of the of the Coast Ranges) in a region known as Kings Mountain. It is approximately 5 miles south of State Route 92 on Hwy 35, along the Skyline Scenic Corridor. This remarkable stretch of largely undeveloped forests, outstanding views and varied ecosystems was designated as a State Scenic Highway in 1966 (Skyline-Santa Cruz Mountains Area Study, San Mateo County Department of Planning, 3.1). It resembles an island of refuge in that it is surrounded by astronomical suburban growth on the eastern side of San Mateo County, and the Pacific Ocean on the west, approximately mid-way between San Francisco and Monterey Bay.

A handful of semi-tucked-away subdivisons occurred in this region between 1908 and 1928 as clear-cut logging of the forests finally began to die down after all accessible harvests had been extracted. These parcels were purchased primarily for weekend and summer homes, but have become the only existing pockets of low density residential development in the region.

The residence is located in the Redwood Park Subdivision, within the Purissima Creek Watershed. It is surrounded by the public lands on all sides, primarily used for low-impact recreation and nature preserves, resource management districts and watersheds. Major land owners include the Midpeninsula Regional Open Space District, Golden Gate National Recreational Areas, County Parks, private estates owned by the National Trust for Historic Preservation and the Peninsula Watershed.

Introduction

Bioregionalism is a design theory that utilizes a thorough analysis of local ecological systems to inspire scientifically and culturally site-appropriate landscapes that can be both subtle and poetic, or grand and artistic in the emotional experiences they invoke. Using the standard methods of design such as hide and reveal, themed rooms or use-areas, balance, proportion or juxtaposition of shapes, sizes and arrangement of objects and empty spaces, the designer takes a step further by looking in a cross-disciplinary manner at the complex and intricate web of relationships between people and the natural world.

Ecological garden designers draw from a variety of disciplines to inform their design decisions, from the arts and humanities to physical and biological sciences, interwoven layers of information form a matrix from which overarching themes, as well as specific details, are drawn. It is difficult to state exactly how one grows as a designer of mere two or three dimensional designs to a multi-dimensional creator of sensory experiences - working with concepts of time, transformation, and patterns of nature. To gain insight for this project, I have looked to the work of several reputable practitioners here in California that have been widely published and celebrated, such as: Ron Lutsko of Lutsko Associates; Bernard Trainor of Trainor & Associates; and Rob Thayer, author and professor emeritus of the UC Davis Department of Landscape Architecture.

An ecological approach to design is gaining broader support in large-scale public infrastructure projects as society becomes more informed about natural processes and the importance of healthy ecosystem functioning for the long-term well-being of us all. In recent years we have seen a tremendous increase in the demand for environmentally sound design in both the corporate and the private world, with constant room for artistic innovation and technological advancement. However, regionally-based design means so much more than designing just a stylish, award-winning, environmentally responsible landscape, in that it seeks to address the deeply embedded human-to-nature psycho-socio-physical complex within us all.

As a child our very first experiences of discovery of the world around us develops our knowledge base, and this information stored within us may or may not include knowledge of the natural world. According to Frances and Reimann in *The California Landscape Garden: Ecology, Culture and Design,* bioregional design attempts to design places to be actively experienced as opposed to "statically viewed" or "cosmetic screens". Places that are sensually and biologically rich, and allow opportunities for the individual to reconnect with the natural world around them. In so doing, not only is our first-hand knowledge of environmental systems restored within us, but we have allowed opportunities for others to live and make these connections as well. In this spirit, a community ethic is cultivated that revolves around a rich involvement with the natural world.

For this project I will be studying the cultural, economic, and environmental history of a region in the Santa Cruz Mountains of Central California to serve as background information for the design development of a regionally appropriate private residential garden. It is a region with a very strong sense of place relating to the ecology of the dominant redwood forest plant community. My research into the natural processes and life cycles of the region (soils, climate, geology, wildlife and vegetation), and some of the human history as well, have expanded my understanding and appreciation of the life lessons I have learned there from the time I was a child. This design approach provides an opportunity to celebrate things such as an appreciation for the passage of time, maturity, diversity, interdependency, life cycles, perseverance, and seasonal changes.

It is the aim of the design to work within a regional framework to promote habitat, energy and resource conservation; and to provide for the functional requirements of the clients. The potential exists for this to become an educational garden for community members interested in ecologically sensitive, resource efficient, stylish design that can be implemented by other landowners with similar requirements.

Regional Context:

Location Map

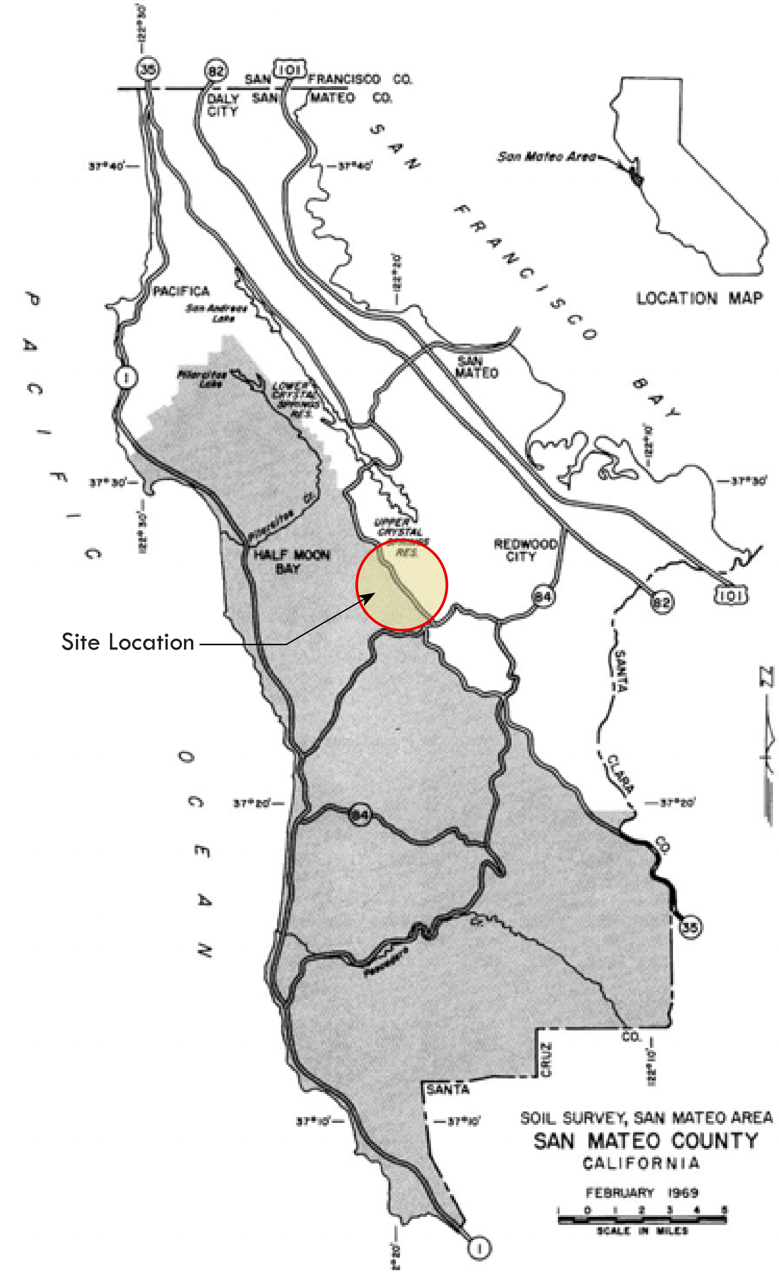


Fig. 1.1 USDA Soil Survey of San Mateo County, CA

Land-Uses

The northern boundary of Kings Mountain is 23,000 acres of watershed land owned primarily by the San Francisco Public Utilities Commission (SFPUC). The Crystal Springs Reservoir is one of ten reservoirs in the Peninsula and Alameda watershed system, built between 1860 -1890 by the Spring Valley Water Company. The Peninsula Watershed in San Mateo County was privately owned by the Bourne family (of the Filoli estate) who purchased the system after the destruction caused to pipelines after the1906 San Francisco Earthquake and Fire. These are currently public lands owned by the city of San Francisco, but access is limited.

The Peninsula and Alameda watersheds contribute approximately 15% to the Bay Area's total potable water supply, with the majority coming from the Hetch Hetchy Valley in Yosemite.

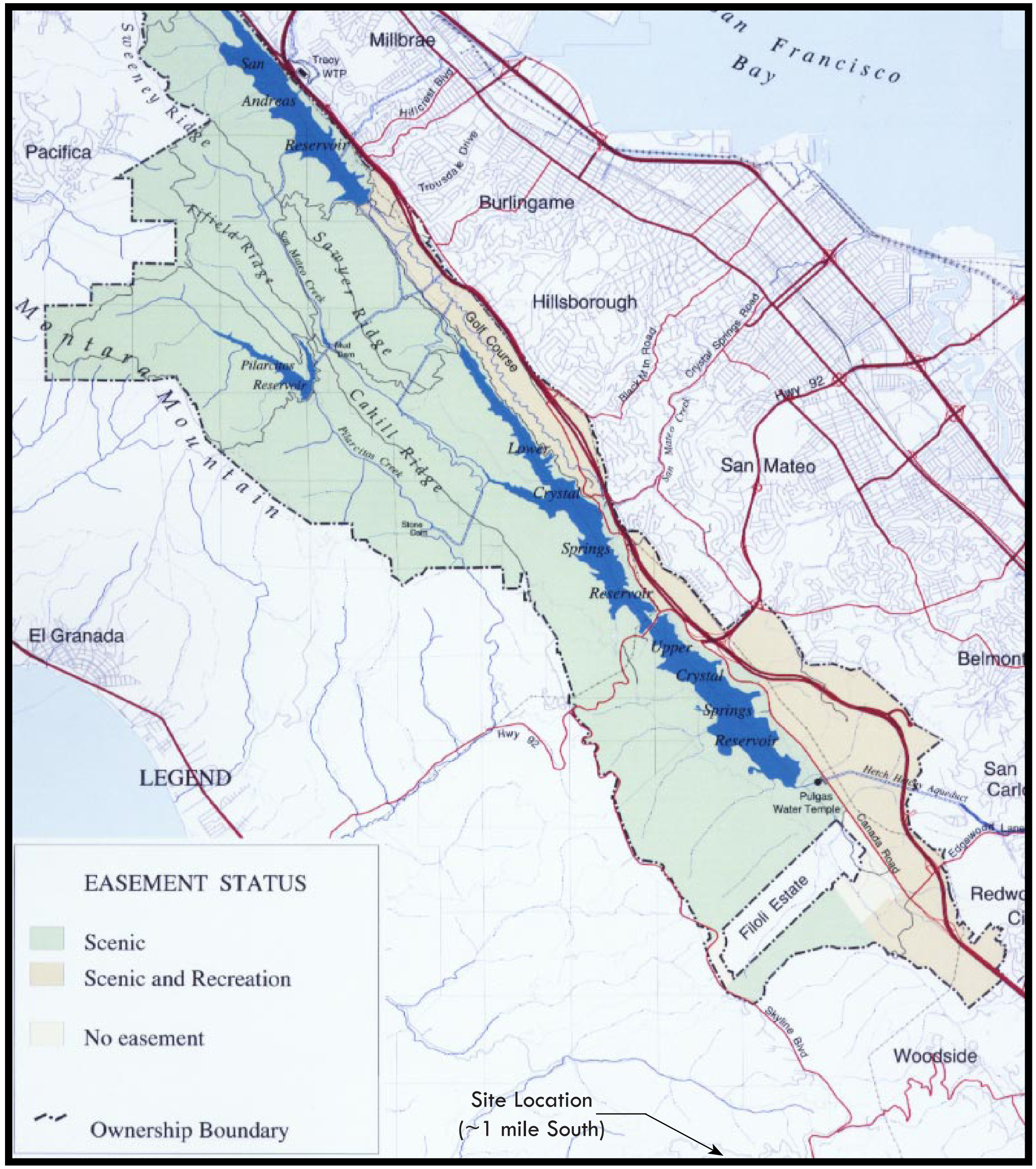


Fig. 1.2 San Francisco Public Utilities Commission, Peninsula Watershed

According to a draft of the Peninsula Watershed Management Plan (SFPUC, 1998. http://sfwater.org/home.cfm), the Hetch Hetchy aqueduct and reservoir system was completed in 1934. Currently, the Crytstal Springs Reservoir (and the SFPUC water delivery system) are the sole source of water for the Skyline County Water District, which services approximately 1,800 people over a 17 sq.mile area. The local water supply infrastructure includes “two 17-stage vertical turbine pumps powered by 300 horsepower motors” to pump water up “a 2,100 foot pump lift, seven miles to the District’s main storage facility (where water) is distributed through 25 miles of transmission main along Skyline Boulevard North to Highway 92 and South to Highway 84” (Skyline County Water District. www.bawsca.org/agencies/SKYLINE.pdf).

The operating expenses of this transport system have resulted in water rates that are currently among the highest in the state. These costs are the cause of a current pending merger between the District and a larger statewide water supply company called Cal Water (California Water Service Company). This merger has numerous implications for the region, including potential rate reductions of nearly 40 percent. However, the inadequacy of the current water-delivery infrastructure has been a key reason for growth restrictions and limits to development up until this point.

Fig. 1.3 and 1.4 Crystal Springs Reservoir and Dam

Wrapping the property directly on the south, west and north sides is the Purissima Creek Redwoods Open Space Preserve and watershed. This particular canyon, along with the nearby watersheds of Tunitas, San Gregorio, Pescadero, and Gazos Creeks, were some of the most heavily logged from the 1850's through the early 20th century. This area was almost entirely deforested, with only a few ancient trees remaining scattered individually in the deepest canyons of Lobitos Creek (Stanger, 52-72; ch.6,7).

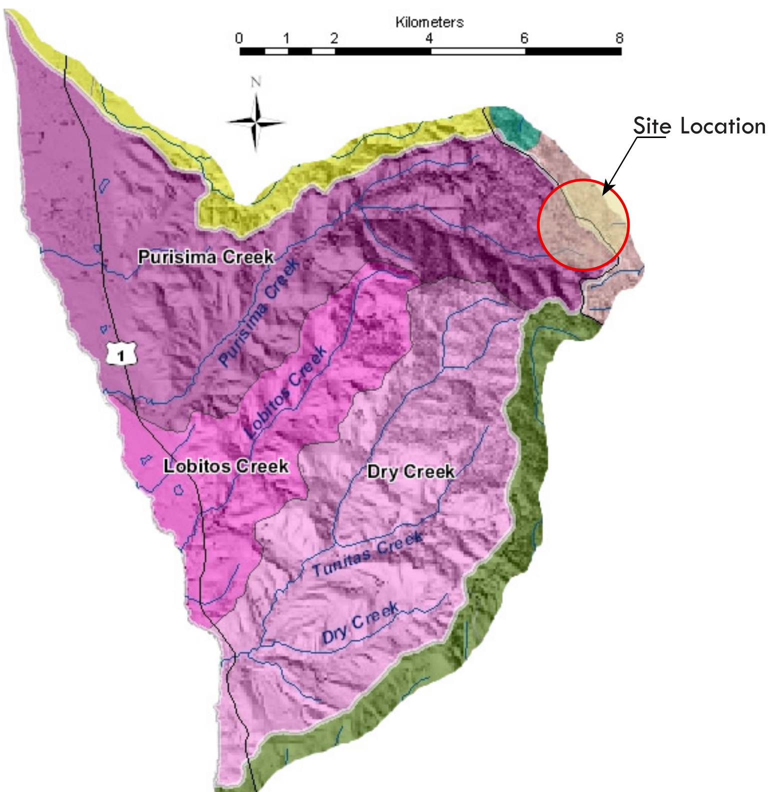


Fig. 1.6 Purissima Creek Watershed

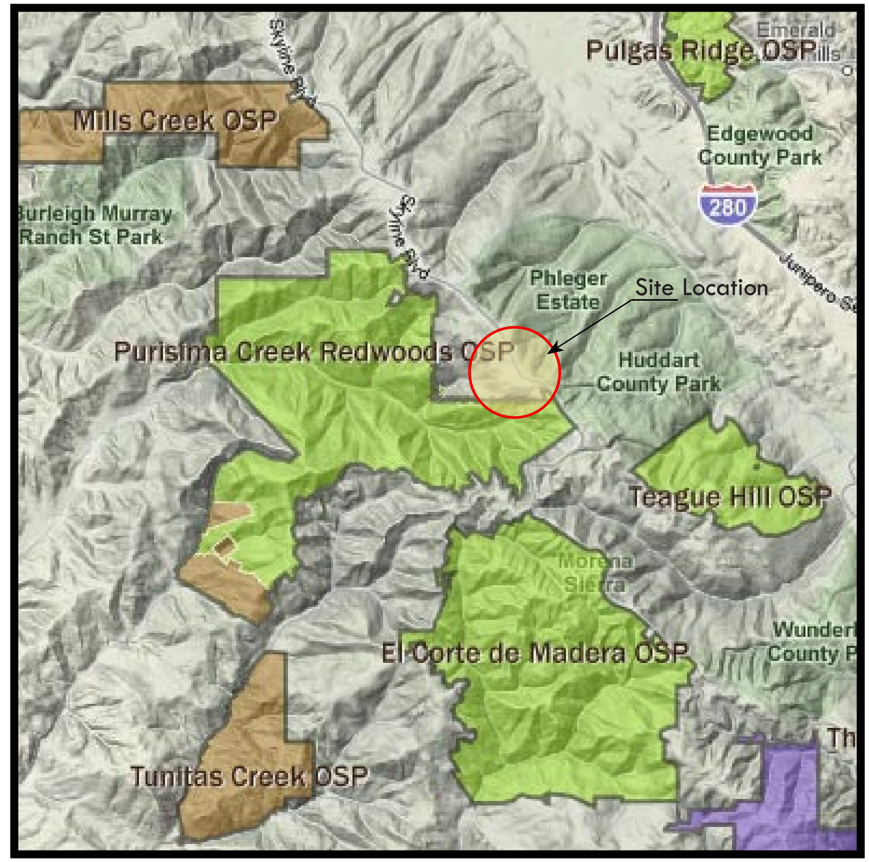


Fig. 1.5 Midpeninsula Regional Open Space Preserves

On the eastern boundary of the property site is the home of the Kings Mountain Volunteer Fire Brigade, Phleger Station, on 5 acres that were donated to the community by the Phleger family. Also the remaining 1,500 acres of the Phleger Estate (owned by the Golden Gate National Reacreation Area since 1995); the Filoli Estate (125 acres of which are owned by the National Trust for Historic Preservation, and 529 acres by the Filoli Center); and Huddart County Park flank the eastern side.

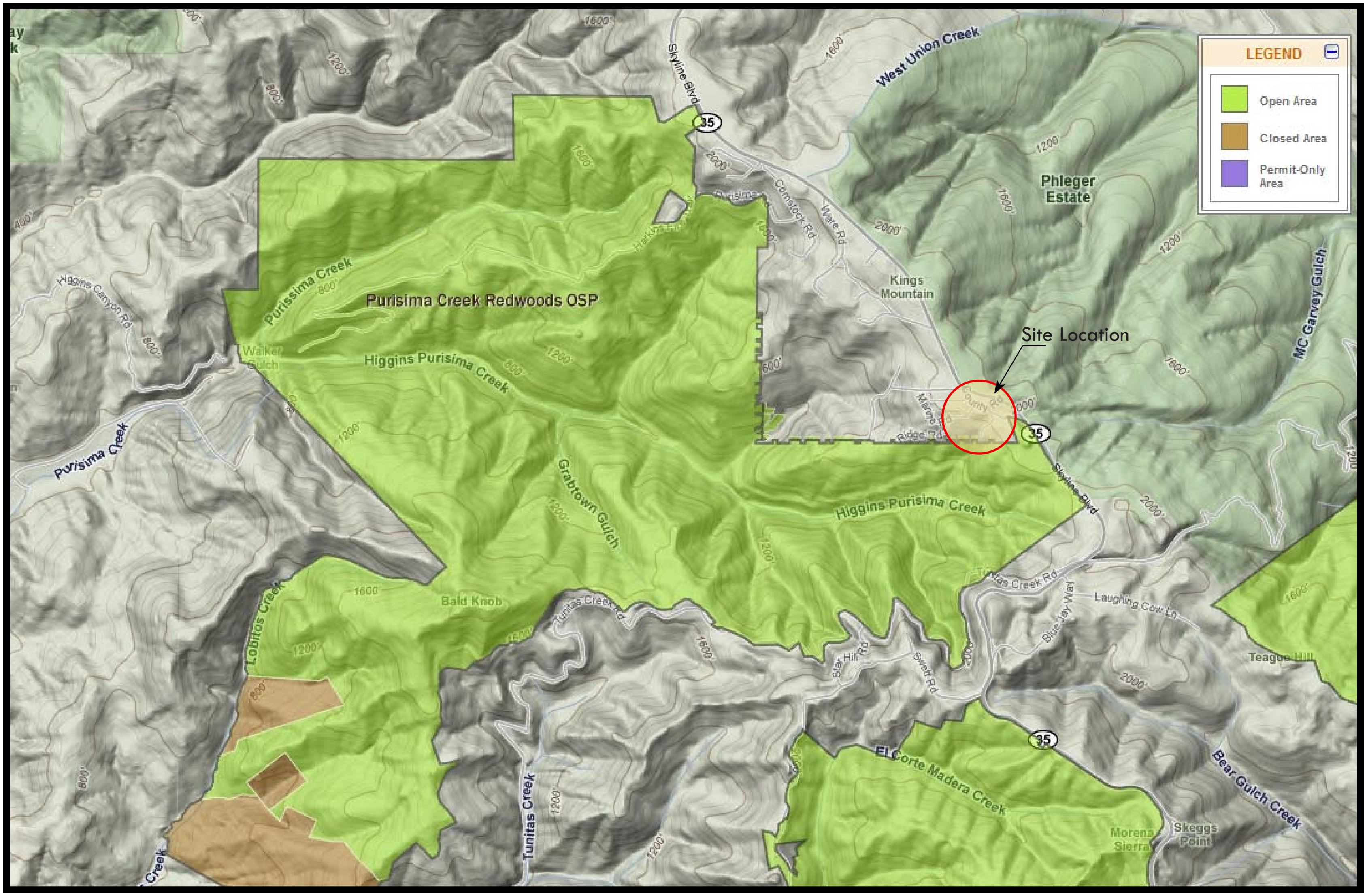


Fig. 1.7 Purissima Creek Redwoods Open Space Preserve, Midpeninsula Regional Open Space District

Zoning:

- Assessor Parcel Number: #067-167-370
- R1 S10 - Single-Family Residential with a minimum lot size of 10,000 sq. ft. and specific development restrictions for setbacks, building heights, etc...
- Unincorporated, rural San Mateo County
- Redwood Park Subdivison
- Legal Description: LOTS 34-40 BLK 3 REDWOOD PARK NO.1 RSM 6/46
- Township & Range: T.6S.R.4W

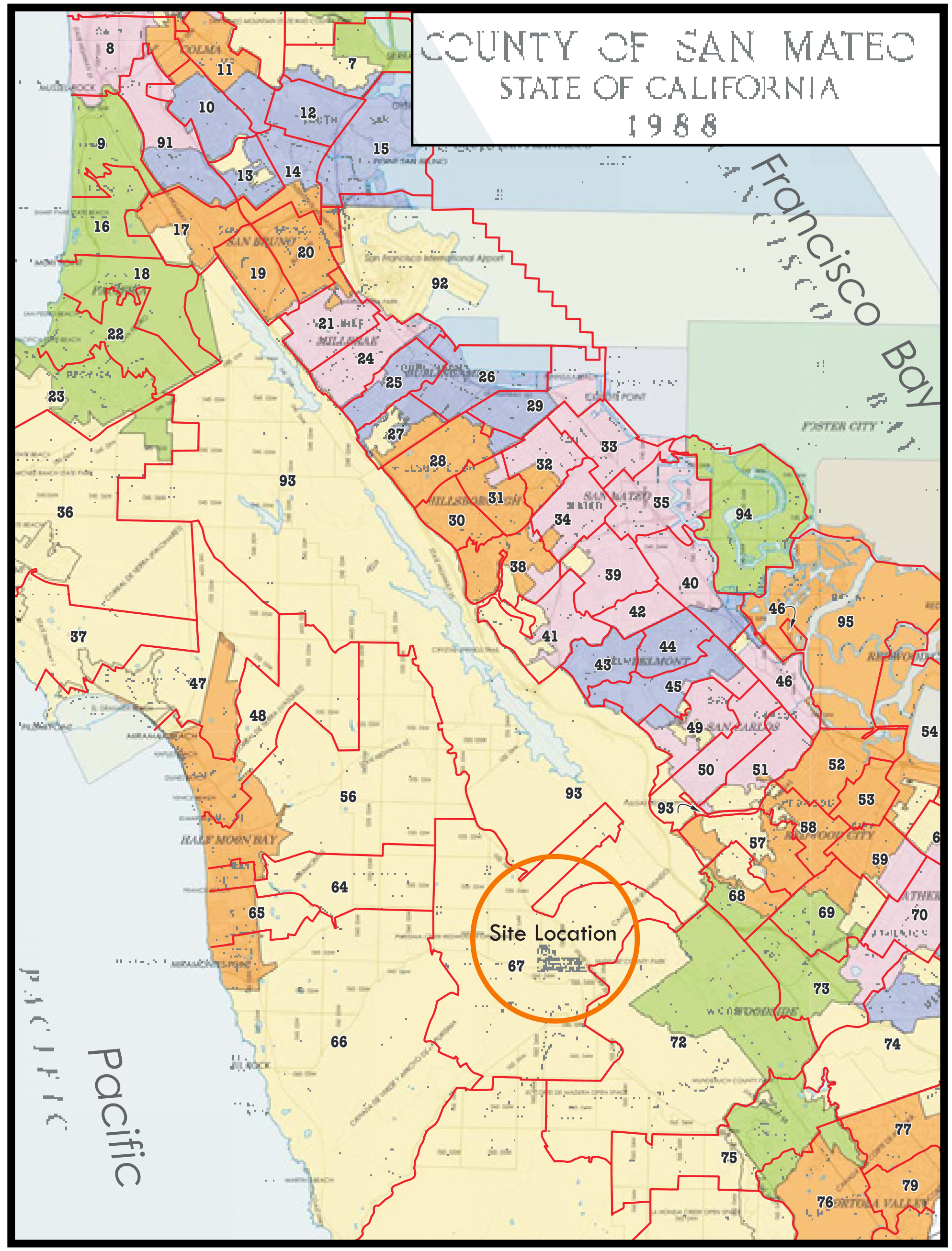


Fig. 1.8 San Mateo County Zoning Map, 1988

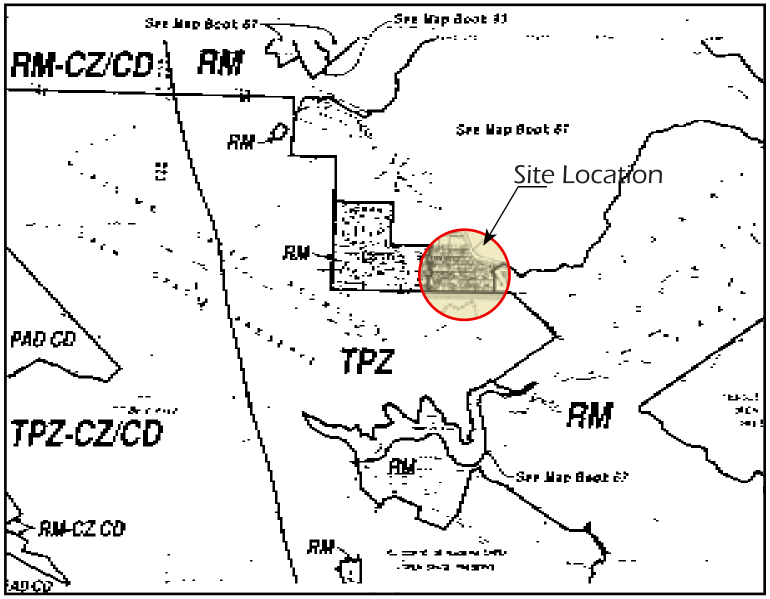


Fig. 1.9 Surrounding RM and TPZ Zoning

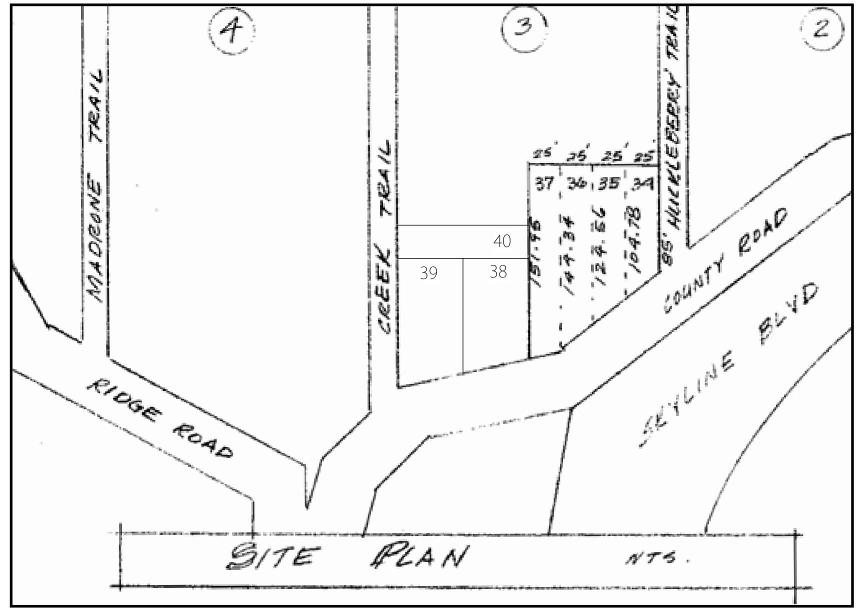


Fig. 1.10 Assessor's Parcel Map for Lots #34-40

Small clusters of residential areas, such as the Redwood Park Subdivision, are surrounded by unsubdivided Resource Management District (RM) and Timberland Preserve (TPZ) zoned areas, as shown above.

In the San Mateo County General Plan there is a Scenic Roads Element which includes architectural and site design criteria for development along the Skyline Scenic Corridor, as well as within RM and TPZ zones. This includes guidelines "on architectural character, materials, color and landscaping to aid and encourage applicants to design structures more appropriate to the scenic character of the Skyline area" (Skyline-Santa Cruz Mountains Area Study, San Mateo County Department of Planning, 3.2).

Ecology:

Geology

According to the opening pages of the *Jepson Manual of the Flowering Plants of California*, the Coast Range Mountains are the result of much more recent geologic activity than either the Sierra Nevada or the Cascade Mountain ranges, ocurring only ~30million years ago. They were formed by the Pacific Plate sliding eastward and northward underneath the North American Plate, causing sedimentary accumulations from the marine floor to be pushed upward along that fold. The margin of the San Andreas Fault line, running in a north-south direction along the spine or the base of the ridge, created the topography as we know it. The inner rift valley, on the eastern side of the fault lines, is where the bulk of urban and some remnant agricultural settlement has occurred.

The geologic formation of this mountainous landform is composed largely of Butano sandstone that has been crushed and folded. It is a sedimentary material highly prone to erosion. The soils differ on the eastern and western sides of the fault system (the Franciscan Complex on the North American plate, and the Salinian Block on the Pacific Plate). Between the mountain peaks there are deep valleys formed by the downcutting of streams over millions of years.

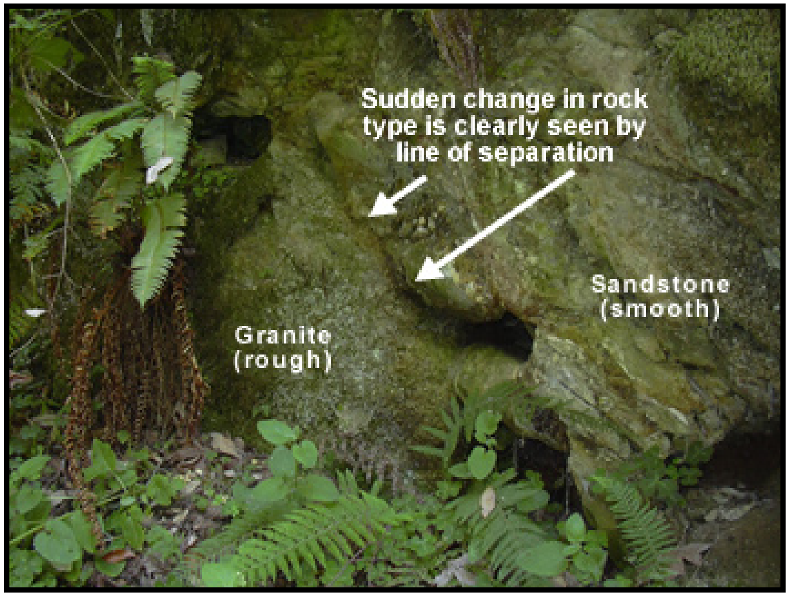


Fig. 2.1 Geology of the Santa Cruz Mountains

According to the Salmonid Habitat Planning Restoration Resource website, these sedimentary landforms have a high probability of landslides, and sedimentation of streams that creates a less desirable spawning habitat for fish such as, salmon. Erosion rates are also highly influenced by land-management practices in watersheds underlain with sedimentary geologic formations. The following data was derived from the NRCS Web Soil Survey Reports for San Mateo County, and confirmed through field studies:

General Soil Characteristics:

The Hugo and Josephine Sandy Loam Series found at the specific site location level were formed from sandstone parent material. It is interesting to note the differences in vegetation throughout the surrounding hills and valleys that are associated with differences in parent material and accumulations (or erosion) of organic matter in the soil horizons.

Detailed Description of Soils on the Site:

- Texture: Sandy loam/Sandy clayey loam
- Organic matter: ~3% (within top 5inches of soil)
- Clay: ~5-13% (throughout soil horizons)
- Sand: ~66% (throughout soil horizons)
- pH: ~6 acidic (more acidic in the deeper layers)
- Drainage: moderately well-drained to poorly drained
- Slopes: steep to moderate, not good for sprinkler irrigation
- Runoff: medium to very rapid
- Percolation: poor to moderate
- Depth to water table: very deep in most areas
- Depth to bedrock: generally shallow due to high rates of erosion
- Distribution and Extent: Coast Range mountains in northwestern California and southwestern Oregon.
- Elevation: Sea-level to 2,400 feet
- Associated Vegetation: Mixed conifer-hardwood forest of Douglas-fir, coast redwood and some grand fir, tanoak, and madrone with an understory of shrubs.

Climate

The topographical features of the Santa Cruz Mountains, and maritime air influences, create moderate temperatures averaging 50F in the winter and 65F in the summer - a mild and humid climate within the coastal fog belt. Rainfall averages between 30 – 40 inches per year, and varies significantly at the local level with higher precipitation on the tops of the ridges and within steep canyons (Skyline-Santa Cruz Mountains Area Study, 5.1–5.19). Snow occasionally falls in the winter, but rarely remains on the ground for more than a day.

Like much of California, there is an annual summer drought that lasts from around June through September, with very little rain usually in either the spring or the fall. The peak rainfall occurs primarily in the winter months from Pacific storms coming from the northwest. The summers are characterized by morning and evening fog, as the sun-scorched inland valleys draw moisture from the cooler Pacific Ocean over the hills. Condensation and fog drip accumulates on the tips of the tall coast redwood trees, providing a significant source of supplemental irrigation to the trees and understory plants during dry summers, as well as causing transpiration rates to be lowered. The north and northeast aspects remain cooler and stay moist longer than the south and southwest aspects, due to less solar heat gain.

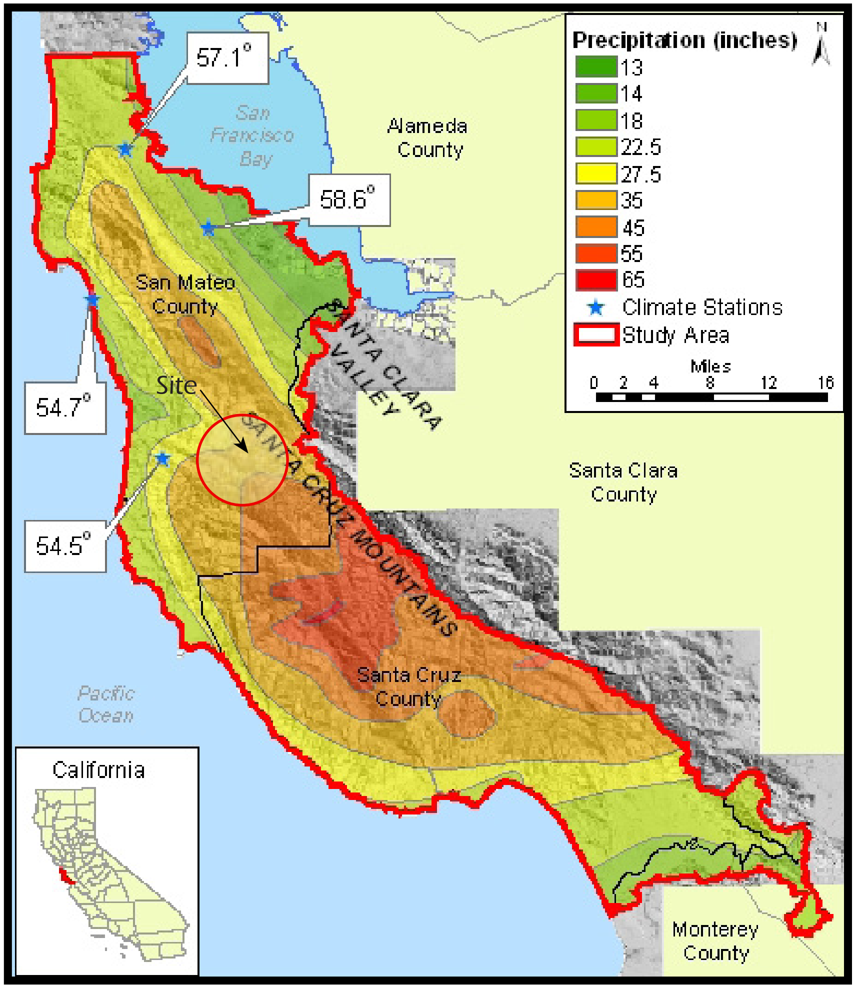


Fig. 2.2 Average Annual Precipitation in the Santa Cruz Mountains

This and other factors related to canopy closure and leaf area cause differences in microclimate and biological activity within the undulating terrain. (Sunset Climate Zone 15)

Vegetation

Within the geographical subdivision of the Central Coast Bioregion there are terrestrial biomes such as: coniferous forest, coastal sage scrub, chaparral, etc… with transition zones between, called eco-tones. Within these biomes are groupings of plants into biotic vegetative communities, usually described by the dominant species, such as the Redwood Forest Biotic Community, (a list of associated species is shown to the right). The redwood forest plant community is geographically distributed based on climatic factors, such as altitudinal and latitudinal variants, and ecological gradients (like mesic to xeric soil conditions, etc…). For example, the temperate humidity caused by the coastal fog in this region has caused it to be the location of one of the states main forest belts.

Plants Associated with the Redwood Forest Biotic Community

Trees:
Sequoia sempervirens
Lithocarpus densiflora
Pseutostsuga taxiflora
Tsuga heterophylla
Picea sitchensis
Abies grandis
Arbutus menziesii
Quercus garryana

Shade-loving herbs:
Tarresia macrophylla
Scoliopus bigelovii
Clintonia andrewsiana
Maianthemum bifolium
Trillium ovatum
Asarum caudatum
Vancouveria parviflora
Achlys triphylla
Saxifraga mertansiana
Oxalis oregana
Viola sarmentosa
Viola ocellata
Mimulus dentate

Shrubs:
Ceanothus thyrsiflorus
Vacciunum ovatum
Gaultheria shallon
Physocarpus capitatus
Holodiscus discolor
Rubus parviflorus
Symphoricarpos albus

The natural distribution of the Coast Redwood Forest Plant Community ranges from the extreme southwest corner of Oregon state to Monterey County, CA. The area known more specifically as the Franciscan zone extends from as far north as Mendocino County to Monterey in the south. In this region there is a very high species diversity associated with the dominant redwood canopy, and a high population of endemic plant species found nowhere else in the world. (Please refer to the Planting Plan section of this report for a detailed description of some of the native plant species ocurring on this site).

CLASSIFICATION ACCORDING TO THE JEPSON MANUAL HIERARCHICAL SYSTEM:

CA-FP California Floristic Province

CW Central Western California Region

SnFrB San Francisco Bay Area Subregion

NoFo North Coastal Forest
(includes Redwood Forest)

Wildlife

The following is a brief introduction to a sample group of the approximately 120 animal species that were found in a database query of The California Wildlife Habitat Relationships System (V.8.2) for the San Mateo County coastal redwood forest habitat. Numbers following the names refer to the population and protection status of the species, a key is provided on the following page.

Fig. 2.5a Fauna in the Redwood Forests of Central California

COMMON NAMES & SPECIES STATUS:

1. Acorn Woodpecker
2. American Kestrel
3. Bobcat
4. Band-Tailed Pigeon 14
5. Hermit Warbler
6. Hermit Thrush
7. Dusky-Footed Woodrat 1, 7
8. Chestnut-Backed Chickadee
9. Mountain Lion 7
10. California Newt
11. Common Garter Snake 1, 3, 5, 7

(continued on the following page.)

KEY FOR DETERMINING PROTECTION AND MANAGEMENT STATUS OF WILDLIFE SPECIES in the CWHR SYSTEM:

1=Federal Endangered

2=Federal Threatened

3=California Endangered

4=California Threatened

5=California Fully Protected

6=California Protected

7=California Species of Special Concern

8=Federally-Proposed Endangered

9=Federally-Proposed Threatened

10=Federal Candidate

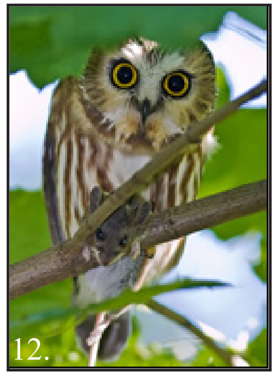
1 1=BLM Sensitive

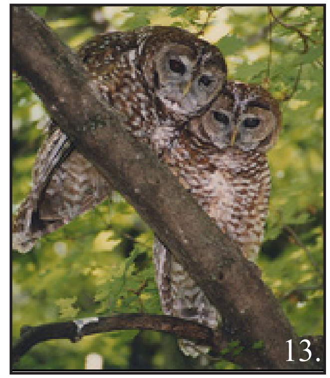
12=USFS Sensitive

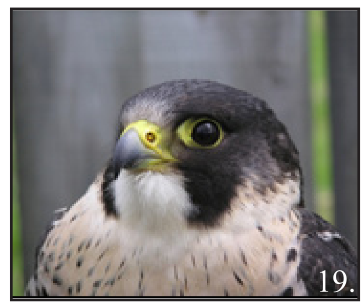
1 3=CDF Sensitive

14 =Harvest

Fig. 2.5b Fauna in the Redwood Forests of Central California, cont.







COMMON NAMES & STATUS (this page):

12. Northern Saw-Whet Owl

13. Spotted Owl 2, 7, 11, 12, 13

14. Northern Pygmy Owl

15. Northern Flicker

16. Red-Tailed Hawk

17. Varied Thrush

18. Pallid Bat 7, 11, 12

19. Peregrine Falcon 3, 5, 12, 13

20. Western Screech Owl

History:

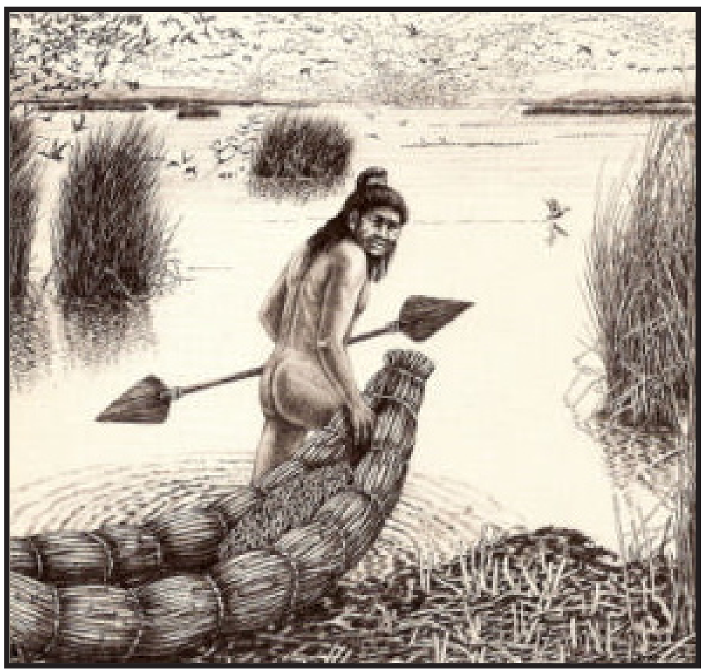


Fig. 3.1 Cover Illustration for The Ohlone Way, M. Margolin

The Ohlone

According to the History Page of the Salmonid Habitat Planning Restoration Resource website, there were forty to fifty different tribes inhabiting the Central California Coastal region (from the areas now known as Big Sur to San Francisco), for more than 4,000 years prior to Spanish settlement. Eight different ethnic groups, made up of forty smaller groups, each with unique dialects and other social features, are now referred to collectively as the Ohlone. The collective name is due to the extensive trade relations that had developed between the autonomous tribal groups.

Some items constructed locally include tule boats (*Scripus acutus* and *Scripus californicus*), nets, harpoons, basket traps, hooks, and fish poisons for fishing salmon, and gathering shellfish such as abalone. They monitored fish runs and limited their catch accordingly. They developed tools for hunting game such as elk, deer, and waterfowl, and elaborate social rituals to accompany these regular events. For the deer hunt, they would fast and pray and sweat in lodges to purify themselves physically and spiritually prior to the hunt.

Margolin describes in his book the lifestyles and economies of trade of the Ohlone people. Not only were they hunters and gatherers, but they were cultivators of desirable seeds, roots and greens. They were semi-nomadic in that they followed seasonally available food - from bayside tule marshes to hunt waterfowl to the oak woodlands and meadows for acorns and grasses, and the Pacific ocean for abalone. They practiced controlled burning of grasslands to keep down the build up of unwanted ladder fuels and provide edge habitat ideal for hunting. Also, the heat from the flames stimulated abundant seed production and germination in certain desirable plants.

Fig. 3.2 Painting of an Ohlone Village

Fig. 3.3 Drawing of an Ohlone Dwelling

Spanish Settlement & Mexican Land Grants

Fig. 3.4 Mission Doloroes, San Francisco - est.1776

With the arrival of the Spanish around 1769, missionary establishments worked to overhaul the Ohlone way of life that had been developing in the region for thousands of years. They were baptized, indentured, and plagued by wars and diseases brought by the Europoean settlers. Their populations and political strength are in recent years finally beginning to recover.

Under Mexican occupation (after declaring independence from Spanish rule in 1820) mission lands were divided into ranchos and granted as large tracts or parcels to citizens as payment for services. At the turn of the 19th century the area south of Crystal Springs Reservoir was known as Cañada de Raymundo - a 12,540-acre Rancho granted to John Coppinger by the Mexican government. On the coastside, land had initially been divided into seven ranchos - also ideal for cattle because of the flat marine terraces and grasslands that had been mantained by Ohlone fire regimes. The first house built in Spanish Town (modern Half Moon Bay) was in 1847. The open range gave way to dairy cattle and smaller farms in the 1850's.

During the gold rush, prior to California statehood in 1850, many squatters were drawn to the region to take part in logging operations that were booming as a result of the rapid metropolitan growth occurring in San Francisco. The unused portions of these large parcels of land would be largely overtaken by squatters, loggers and ranchers, and divided up in the courts as they staked their claims to the land. Since the wealth of many rancheros was often tied up in their land, in order to pay the steep legal fees associated with lengthy court battles they often ended up either having to sell off portions of their land or else accept the threats to their claims.

Lumbering to the Present

Frank Stanger provides a rich and detailed account of the settlement and lumbering of this region in his book *Sawmills in the Redwoods,* during the peak period of 1850 to1870, but continuing to this day. According to him, logging began first and most heavily along the eastern portions of the county, and when all the accessible timber was logged out operations moved higher into the mountain ridges, and eventually down the western slopes.

The delay in logging of the western canyons was due primarily to the inaccessibility of the steeply sloping terrain, and the long distance to reach the only adequate shipping ports in Redwood City.

Despite delays in accessing the deep canyon reaches of the Purissima, Tunitas, San Gregorio, Pescadero, San Gregorio and Gazos Creek watersheds, loggers perservered. Between the 1850's and 1920's these areas were some of the most heavily logged.

The original photographs shown to the right depict some of the very first human settlements in the region. Dr. Tripp's Woodside Store at the eastern base of the mountain provided goods and supplies to loggers, and is preserved to this day as a museum. The Summit Springs Hotel (at the ridge of the mountain) provided logdging to teamsters on their two-day journeys to the bay.

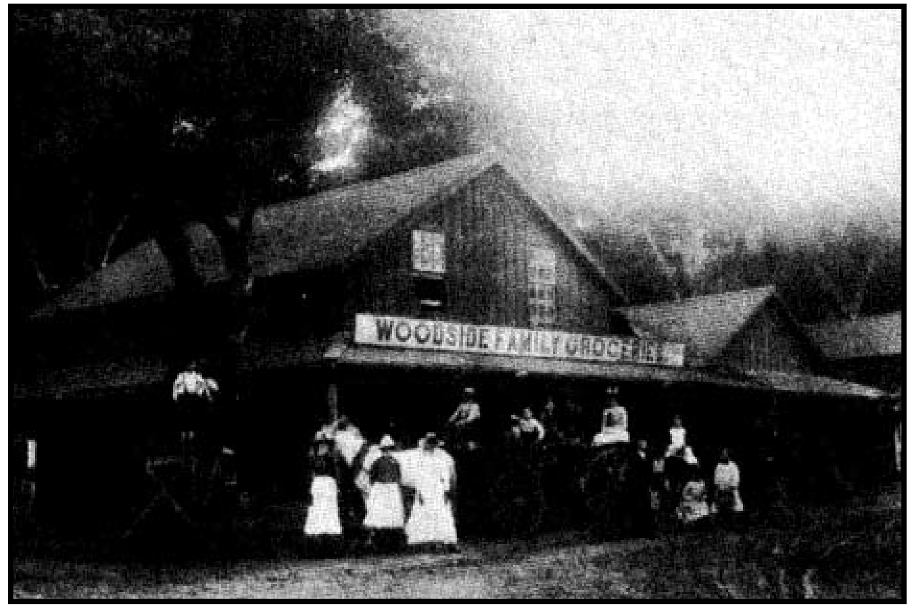


Fig. 3.5 Dr. Tripp's Woodside Store, circa 1850's

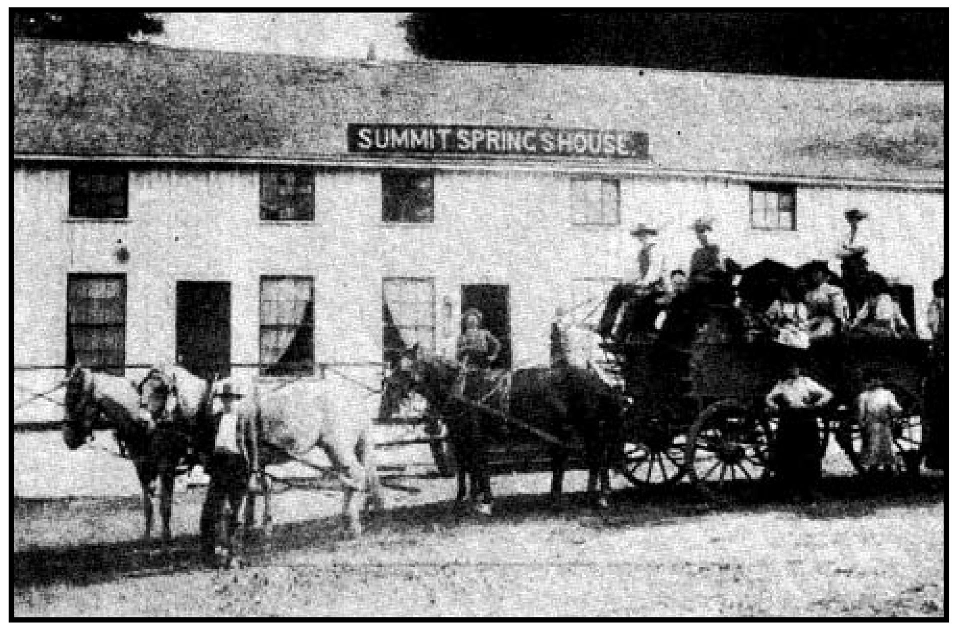


Fig. 3.6 Summit Springs Hotel, circa 1870's

The logging life was tough, and there were many casualties associated with the risky business of lumbering. The hills were populated by grizzly bears at the time, and fatal attacks have been documented. But these men were entrepreneurs and they struggled to develop the tools needed to extract even the hardest-to-reach timber. Water-powered mills were replaced by steam power very early on, allowing milling operations to continue throughout the dry summer months. Evolutions in sawmill technology from manual push-pull saws to power-driven, automated "gang mills" and finally the circular saw provided loggers opportunities to increase production rates and decrease costs (Stanger 135-139; ch 13).

Fig. 3.8 A team of oxen hauling logs

Fig. 3.7 Old-growth Redwoods, circa 1905

Fig. 3.9 From stagecoach to the automobile

Between1908 and 1928 a handful of rural areas were subdivided for the purpose of residential development, primarily for weekend and summer homes (Skyline - Santa Cruz Mountains Area Study 2.1 - 2.3). For example, the Sons of Norway clubhouse was built in 1923 and continues to function as a cultural resource to this day. These small pockets of single-family dwellings have become the permanent residential areas of Kings Mountain as we know them today.

Also in the 1920's was a peculiar period in the nation's history under which Prohibition came into law. The Santa Cruz Mountains became a hide-away of sorts for clandestine liquor operations - from production and trade to the smuggling of imported liquor from Canada. Bootleggers ran operations

Fig. 3.10 Sons of Norway Clubhouse

Fig. 3.11 Al Knudsnon's Place

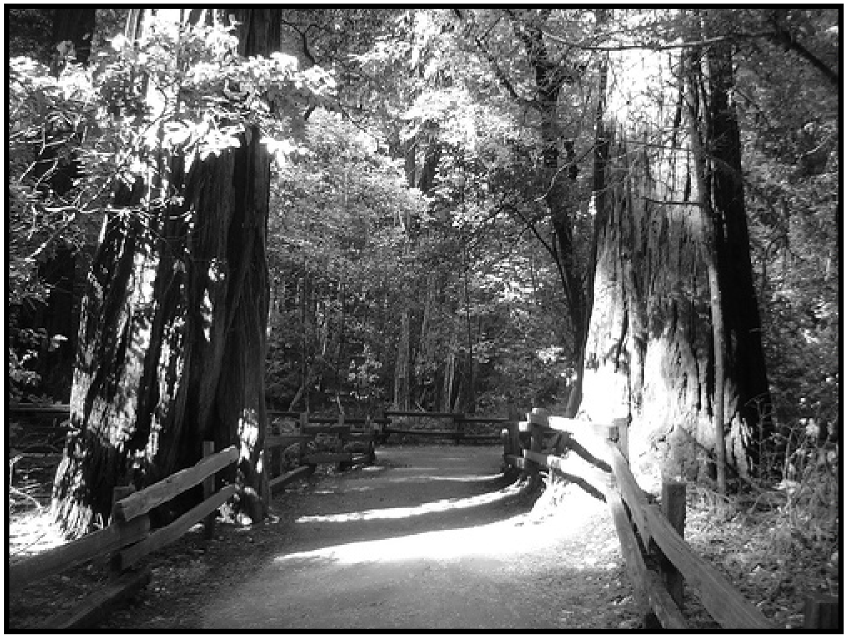


Fig. 3.12

throughout the peninsula, and from the 1920's to the 1940's the Kings Mountain area was home to a number of bars, brothels, and speakeasy's where tourists from the cities could buy liquor, rent a room, and live outside of the law, if only for a night. Only two of these original bars remain to this day, and although they continue to be tourist destinations, as the old speakeasy's were, they have since been converted to reputable fine-dining establishments.

Another significant development in the region took place during the late 1960's and early 1970's when voters approved a ballot measure for the creation of an open space preservation district. Since the creation of the Midpeninsula Regional Open Space District in 1972, and the Peninsula Open Space Trust in 1977, almost 120,000 acres of land (surrounding Kings Mountain and throughout the peninsula) have been purchased for the sole purpose of preservation.

Logging continues to take place on lands zoned for Timber Production (TP), particularly in regions south of Purisima Creek, providing resources and revenues for the county. However, debate rages over regulations affecting the industry (such as, in the case of Big Creek Lumber vs. San Mateo County, State Supreme Court 1995; and Big Creek Lumber vs. Santa Cruz County, State Supreme Court 2006.)

After nearly one hundred and fifty-years of largely unrestrained operations, logging companies are strongly reluctant to abide by new and improved county restrictions and forest management strategies. However, the inclusion of environmental impact requirements into timber harvest plans, such as protective riparian buffer zones, selective thinning of stands, monitoring of sedimentation in creeks, and erosion control from roads and landslides, is gaining political ground and popular support. These management strategies will

Fig. 3.13

promote the recovery of water quality in streams, the protection of aquatic life, and the forest ecosystem at large (Salmonid Habitat Planning Restoration Resource).

Site Analysis:

Existing Conditions

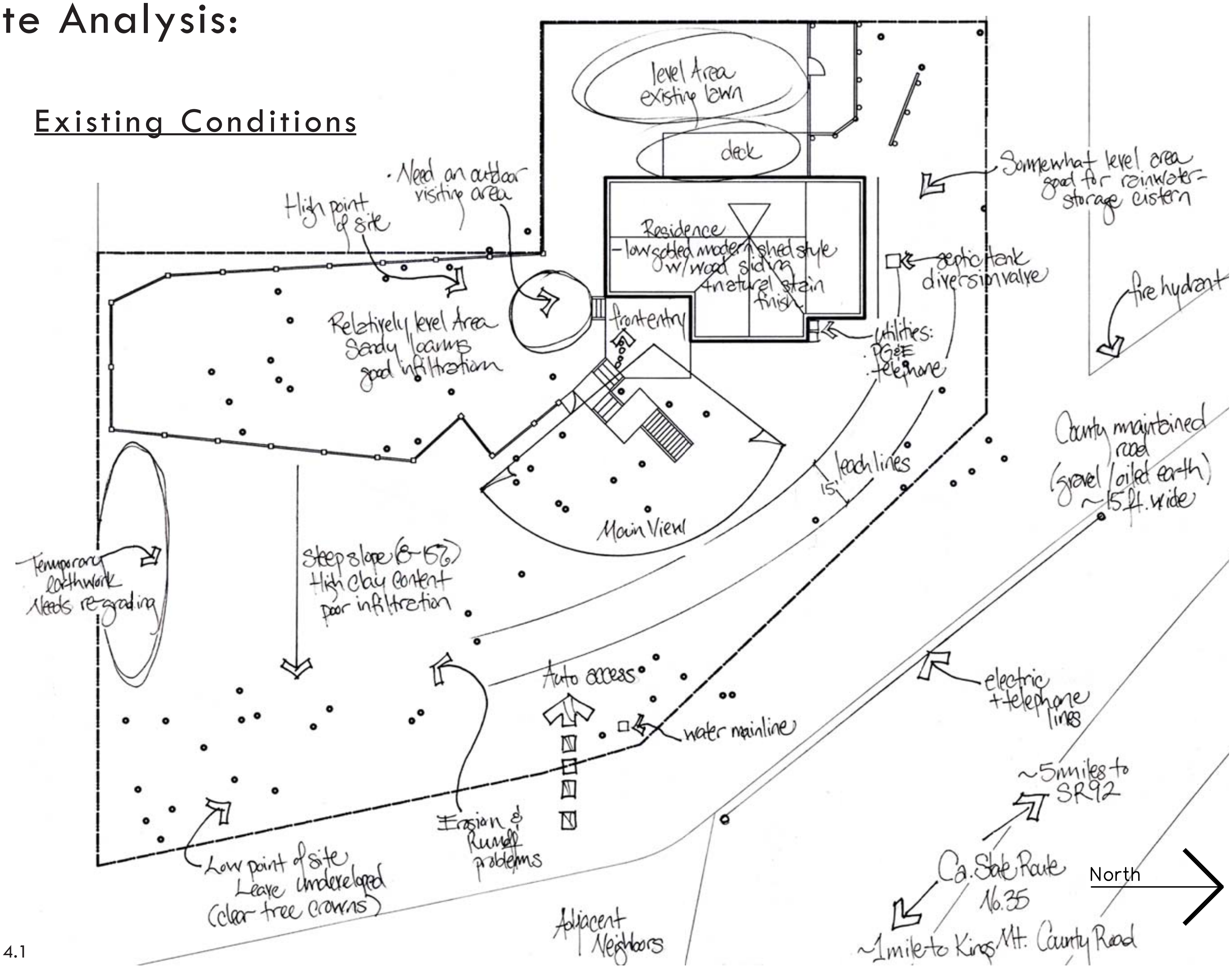
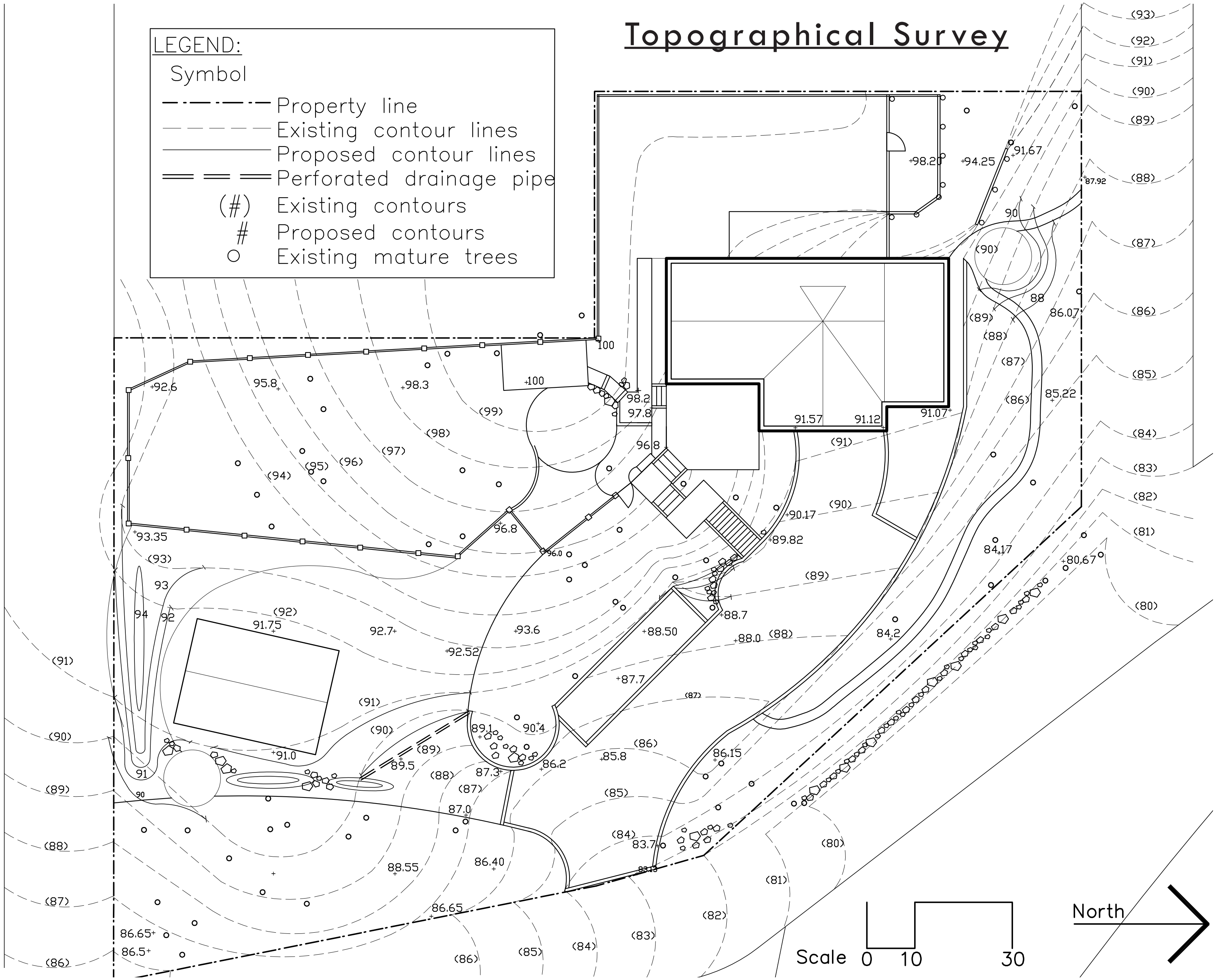


Fig. 4.1


Topographical Survey
LEGEND:
Symbol
Property line
Existing contour lines
Proposed contour lines
Perforated drainage pipe
(#) Existing contours
Proposed contours
Existing mature trees
Scale 0 10 30
North
Fig. 4.2

Slope Analysis

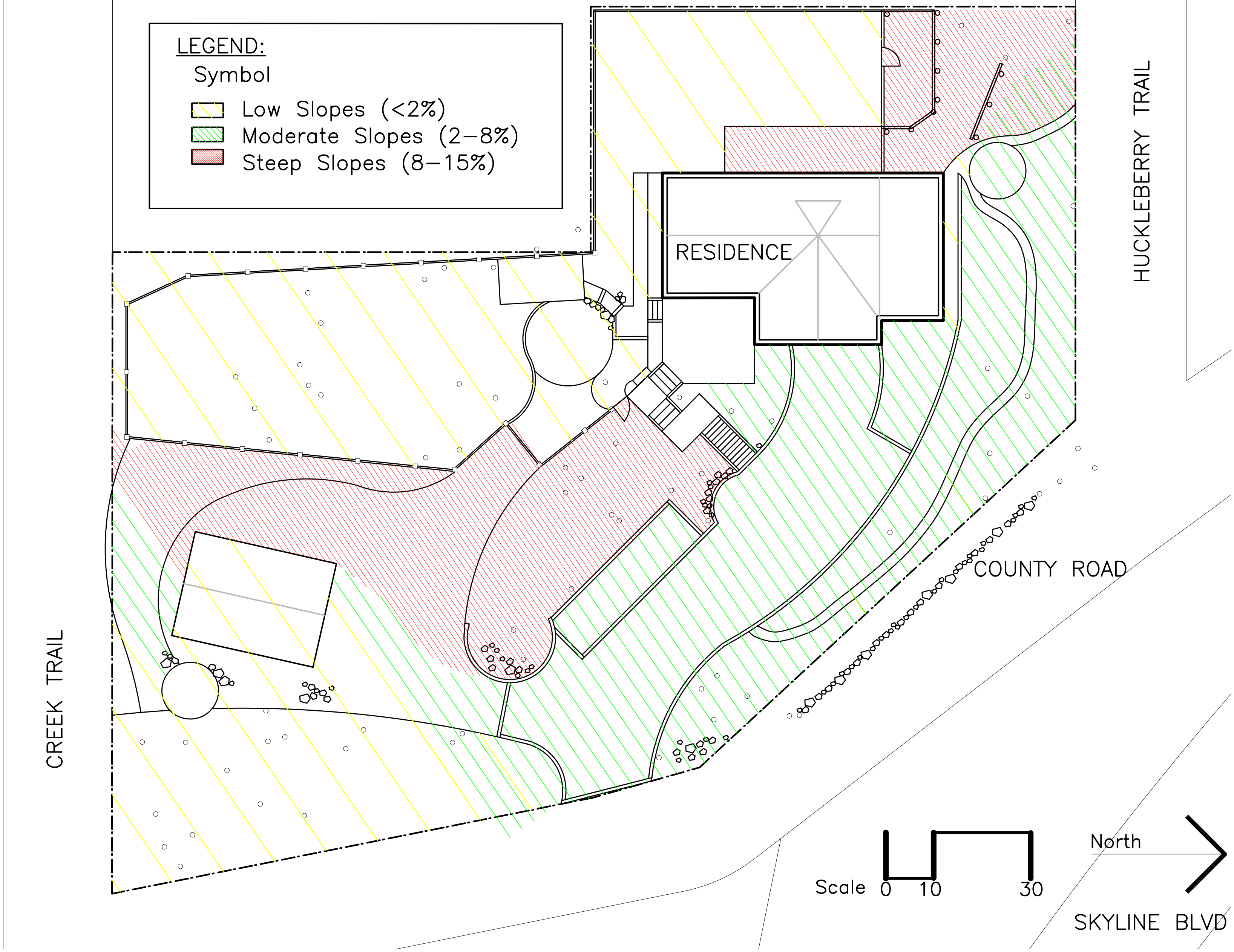


Fig. 4.3

Hydrozones

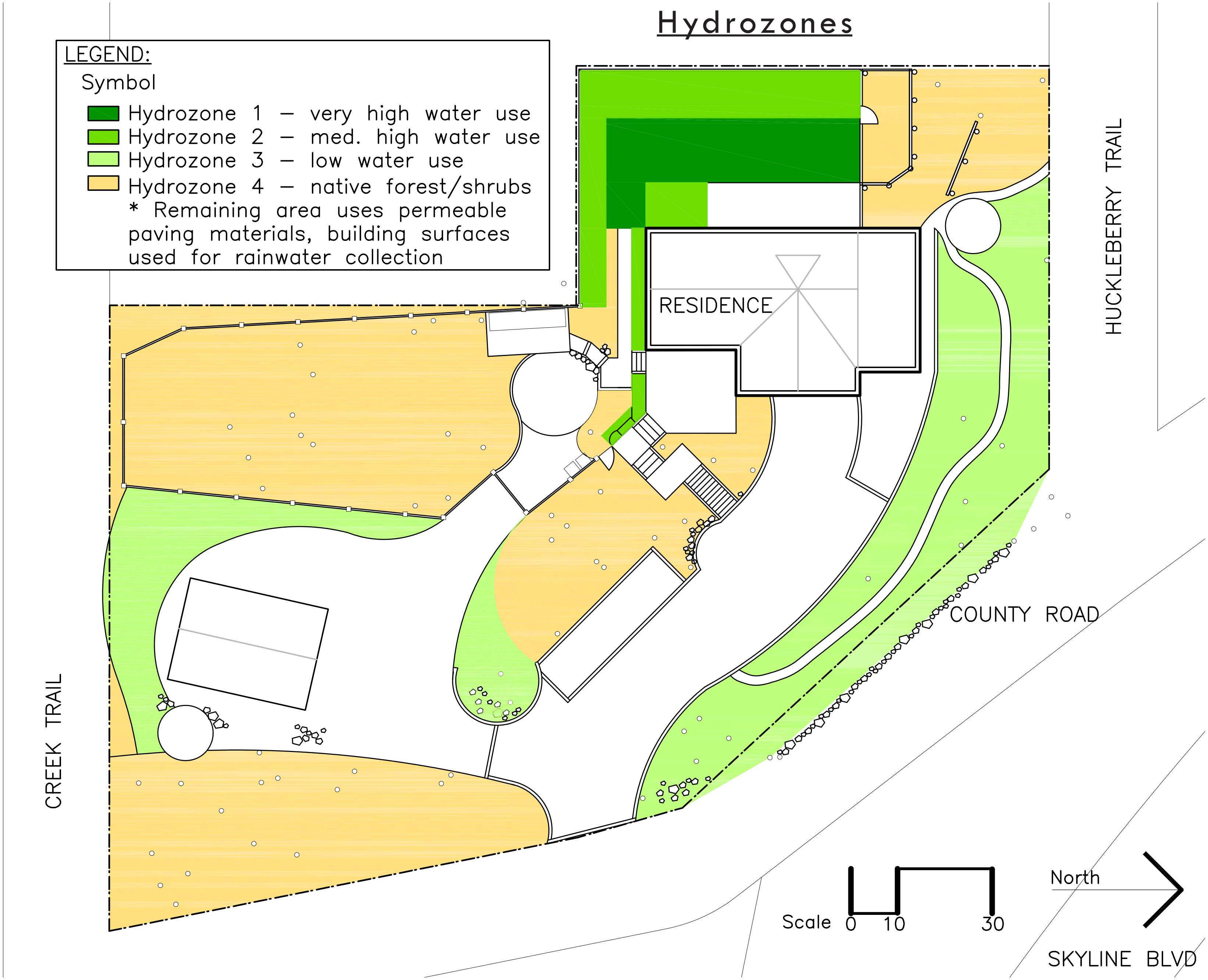


Fig. 4.4

Program Development:

Program Goals

To develop a landscape proposal based on principles of Bioregional Design Theory, that includes the following elements:

- Access, circulation and acitivity areas that meet the daily requirements of clients.
- Best Management Strategies that slow stormwater runoff from leaving the site, and encourage water and energy conservation, such as a rainwater catchment system, permeable pavers, and effective irrigation system planning.
- Expanded planting areas that include a diversity of plant species native to California. Plants shall be drought-tolerant or seasonally adapted, and provide habitat for pollinating insects and birds. Owl boxes and other specific strategies to protect wildlife will be employed.
- The use of local building materials will contribute to the sense of a regionally-appropriate design palette, as well as reduce the carbon emissions created by long-distance trucking of supplies.

Water-Use Study

According to an analysis of the existing water-usage for the 2007 billing cycle, the clients water bill for outdoor irrigation on the site approaches nearly 100,000 gallons of water per year! (This figure was determined by subtracting a base rate of 2 units, during months when no outdoor irrigation was used, across twelve-months, to find 118 total units used for outdoor irrigation purposes). Since each unit is equal to 100 cubic feet (748 gallons), the total amount of water used in the landscape during 2007 was 11,800 cubic feet (or 88,264 gallons). The chart in Figure 5.1 provides a monthly break down for usage distributed over the year.

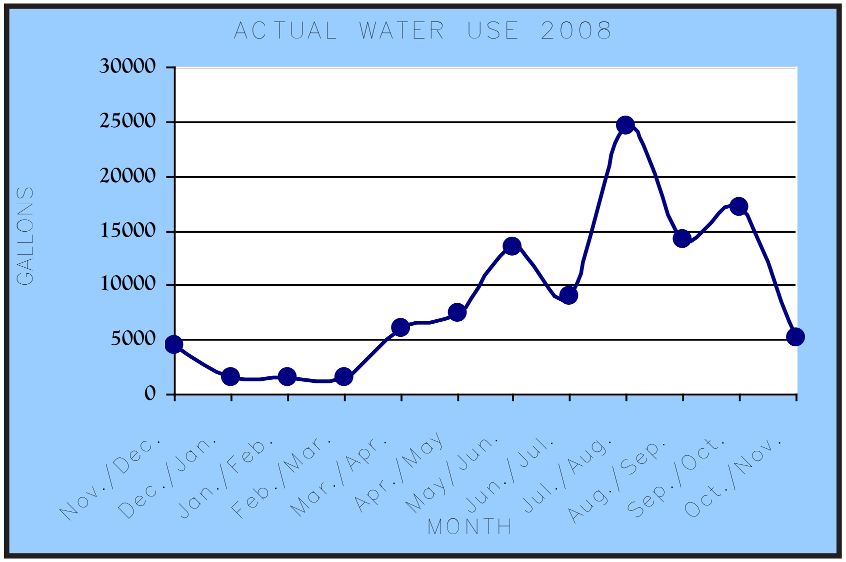


Fig. 5.1 Current Water Quantity Used for Outdoor Irrigation

Using the Stormwater Runoff Volume Calculator developed by the UC Davis Extension Center for Water and Land Use, in conjunction with the California State Water Resources Control Board, I began to address the need for alternative storm water management systems (ASWMS) on this site to mitigate the volume of storm water runoff generated. The calculator works to determine the total anticipated storm water runoff from the site (for an 85th percentile storm event for San Mateo County) dependent upon factors such as, the area of impermeable surfaces, soil infiltration rates, land-cover and trees. Credits are given for mitigation strategies such as, rainwater harvesting, the use of permeable surfaces, vegetative swales, the protection and planting of trees, and other best management strategies.

The site was divided into two main sub-watersheds on the eastern and western halves of the property, due to distinct differences in soil types and infiltration rates on either side. Although the implementation of a bio-retention facility of any significant size does not seem feasible on this site (because of the nearly seventy, two-foot diameter-breast-height trees and an extensive network of roots that would be significantly disturbed by any type of trenching), other techniques seem more applicable to this site.

In the case of another setting where bioretention facilities are more feasible, a second worksheet is available to calculate the sizing requirements. According to the Stormwater Runoff Volume calculations, runoff figures generated were ~140cu.ft. of runoff for each sub-watershed. However, the amount of runoff that can be offset by the use of permeable paving materials, rainwater collection cisterns, and the preservation of existing forest cover is over 20,000 cu.ft. for each sub-watershed. Therefore, these will be the main recovery strategies implemented.

EAWU & the WUCOLS System

Determining the Estimated Annual Water Use (EAWU) with the Water-Use Classification of Landscape Species System (WUCOLS) is a process developed by the University of California Cooperative Extension and the California Department of Water Resources. It works by first determining water loss in an environment due to factors such as regional climate and micro-climate, plant type (i.e. adaptations to drought) and evapotranspiration rates. This information tells you exactly (or close to) how much water your planting areas will *require* in order to survive and photosynthesize at optimal levels – no more, no less. The quality of your irrigation system design will influence how much of the actual water being applied is being used by plants, and how much is being wasted (in most cases this is a percentage loss that must be added to the total irrigation requirements). According to this analysis, the site for this project should only require around 15,000 gallons of irrigation water annually. That is a fraction of what is currently being used (a reduction of almost 80%!), including an expansion in planting areas of over several thousand square feet.

Potential for Rainwater Collection

The calculations for determining potential rainfall collection are straightforward - a detailed explanation of the steps is given below:

1. Multiply the square footage of the roof of the building structure by the average annual rainfall (ft./yr.).

Area (sq.ft.) X Average Annual Rainfall (ft./yr.) = cu.ft./yr.

i.e. 1,800 sq.ft. X 2.67ft./yr. = 4,806 cu.ft./yr.

2. Multiply the resulting figure by 80% to account for a 20% loss due to inefficiencies from things such as, evaporation, splashing, leaks, etc…).

i.e 4,806 cu.ft./yr. X .80 = 3,845 cu.ft./yr.

3. Multiply by 7.48gallons/cu.ft. to convert from cu./ft. to gallons.

i.e. 3,845 X 7.48 = **28,759 gallons/yr.**

4. Follow the same formula for any additional proposed outbuildings that can be used as collection surfaces.

i.e. a proposed office/barn = an additional **11,000 gallons/yr.**

Design Development:

Functional Diagram

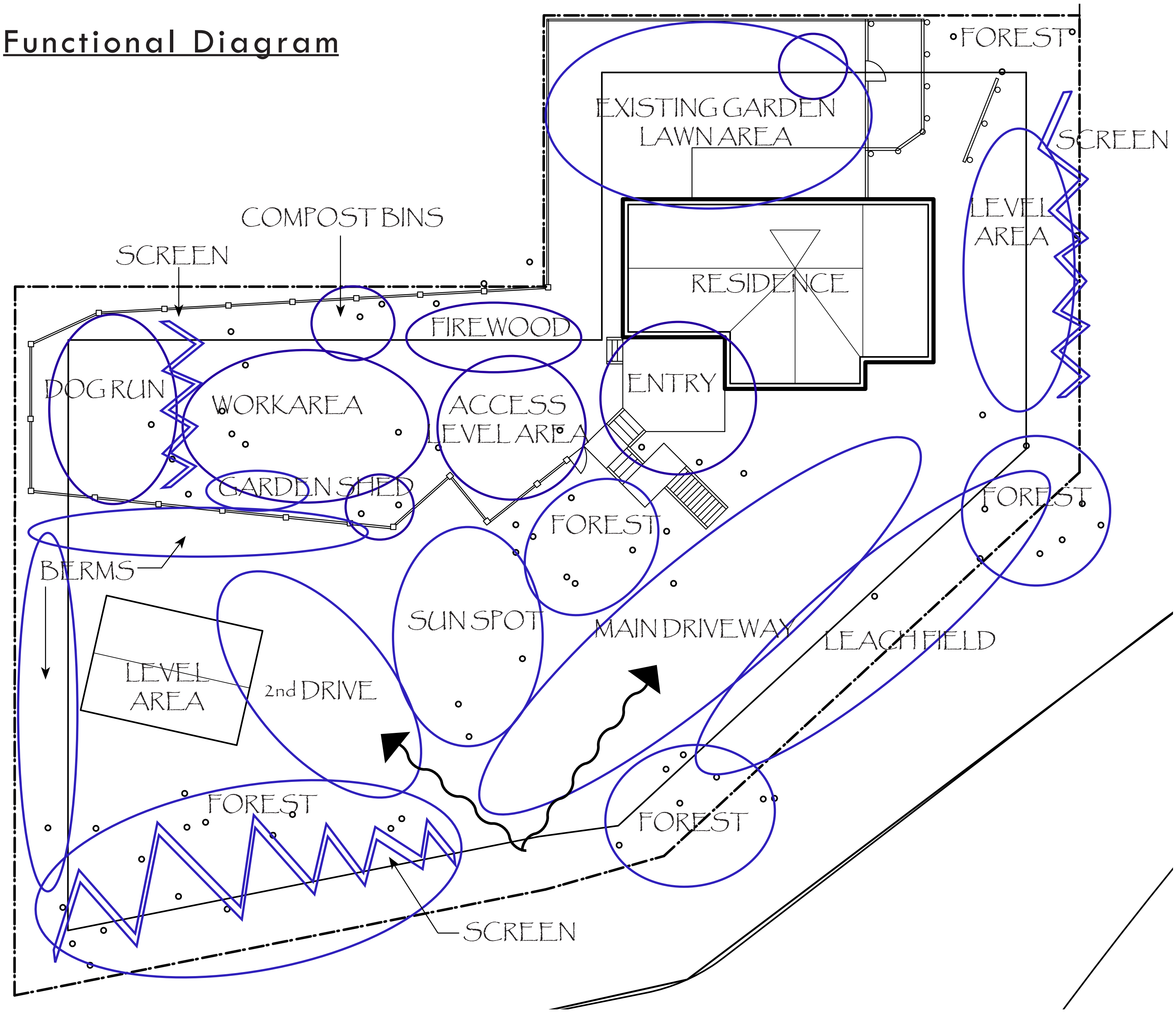


Fig. 6.1

Master Plan

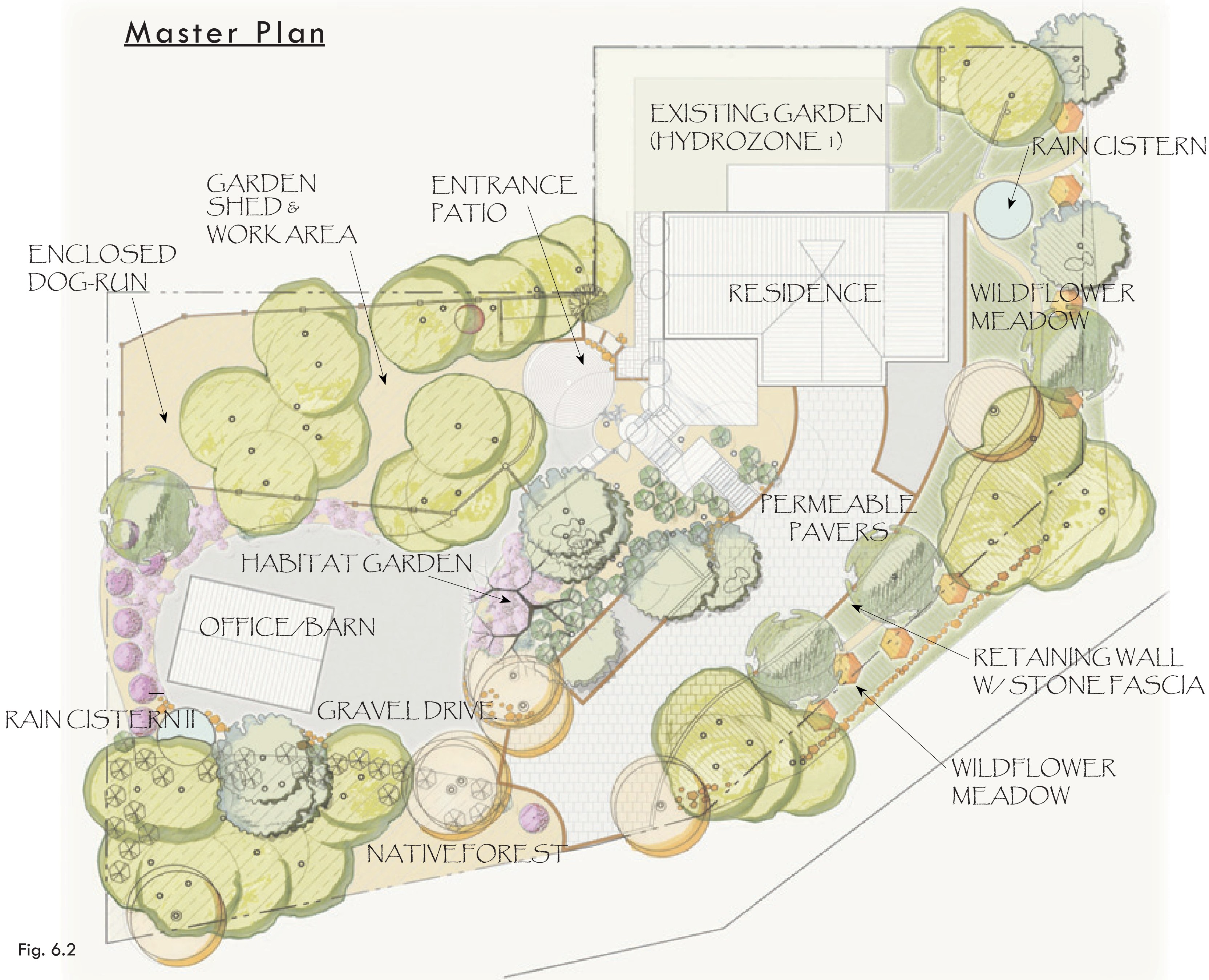
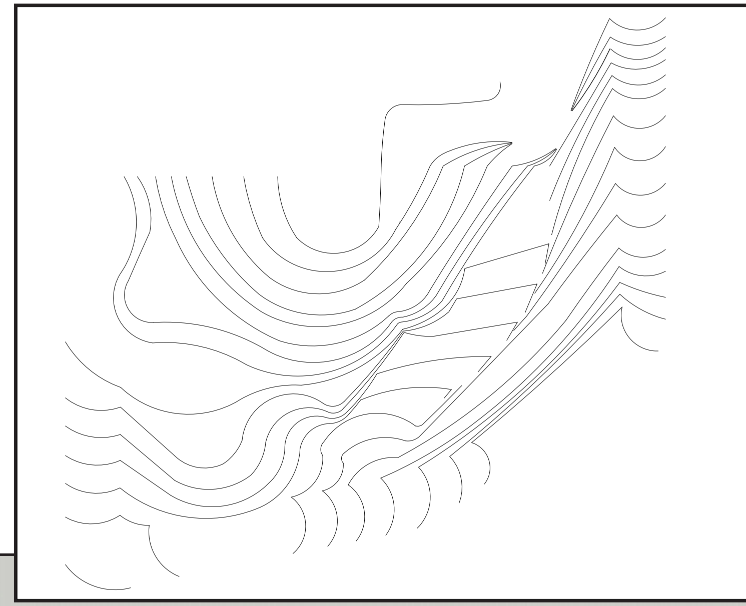


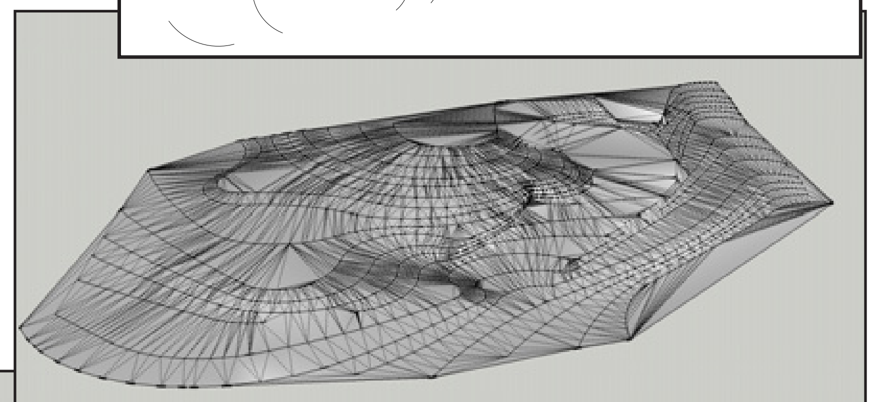
Fig. 6.2

Building a Topographical 3-D Model

EXPLANATION OF STEPS:

1. Begin with constructing a 2-dimensional contour map from either spot elevations taken by a professional survey engineer or your own measurements. Although programs exist that can interpolate where the contour lines lie between spot elevations, it can easily be calculated by hand and then drafted into AutoCAD.
2. Import the 2-D contour lines from AutoCAD into Google SkethUp, (File - Import - AutoCAD dwg). In SketchUp, go into (Windows - Preferences) to make sure that the Sandbox tools are selected. Make sure that all of your lines are completely connected and not touching each other. Select each line individually and give it an appropriate vertical (z) elevation. Highlight all of the contours and go into (Draw - Sandbox - from contours). This will initiate the program conversion of separate lines into a component TIN (triangulated irregular network).
3. The TIN can be read either with or without the hidden geometry and edges of lines showing (View - Hidden Geometry - Edge Style). There may be errors in the model in places where the program could not read your lines - specifically along walls if you failed to connect all of your lines and to be certain that they are separate from one another. (There are techniques in Google SketchUp for making corrections to the TIN model).





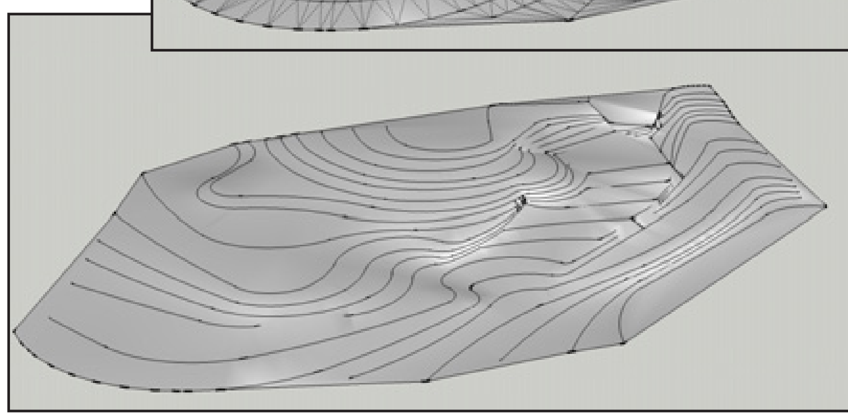


Fig. 6.3a, 6.3b, 6.3c

4. The next step is to drape the revised base plan, including the location of all major structural features, building footprints, existing trees that will remain, and the outlines of other important features, over the TIN model. Make sure that you are working with the same boundary limitations as were used to create the TIN model from the 2-D contours. Import the CAD file base map into SketchUp, and drag as a component until it is aligned directly above the TIN model. Then explode the base map and go into (Tools - Sandbox - Drape). It will ask you to selct the entities you wish to drape, and the mesh on which you wish to drape.
5. Once you have the location of all major items draped over the TIN model, you are ready to begin modeling. You can paint the triangular components of the TIN model individually by turning on the hidden geometry (Views - Hidden Geometry), or as a whole by leaving geometry turned off. It is recommended that you build your larger elements in separate documents and bring them into your model as components. This prevents the file from becoming too large and slowing down the processing speed. Under (Tools - Sandbox - Stamp) you can integrate built components into the TIN model by either bringing the mesh up to meet the component on a level plane, or bringing the item down into the mesh.

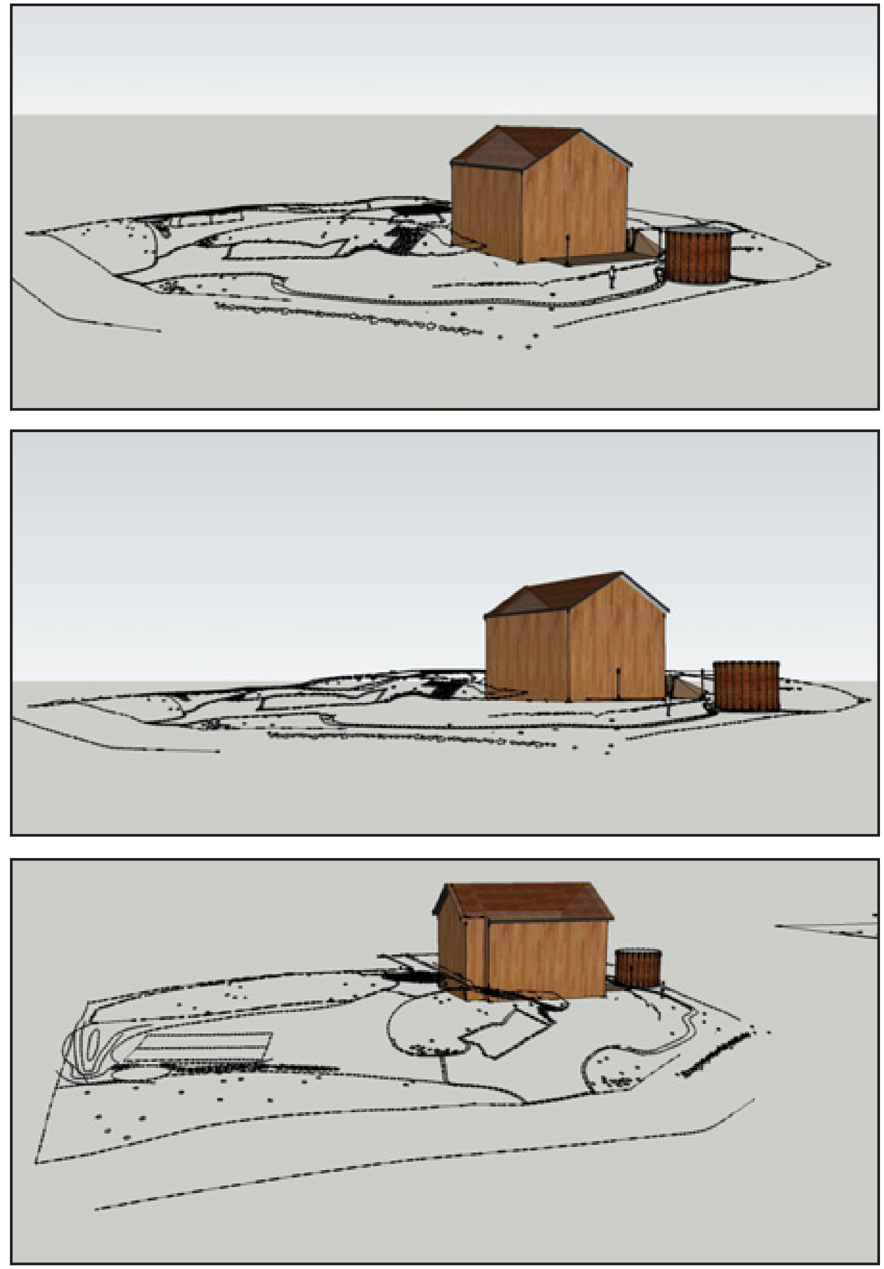


Fig. 6.4a, 6.4b, 6.4c Draping a base map over the TIN model

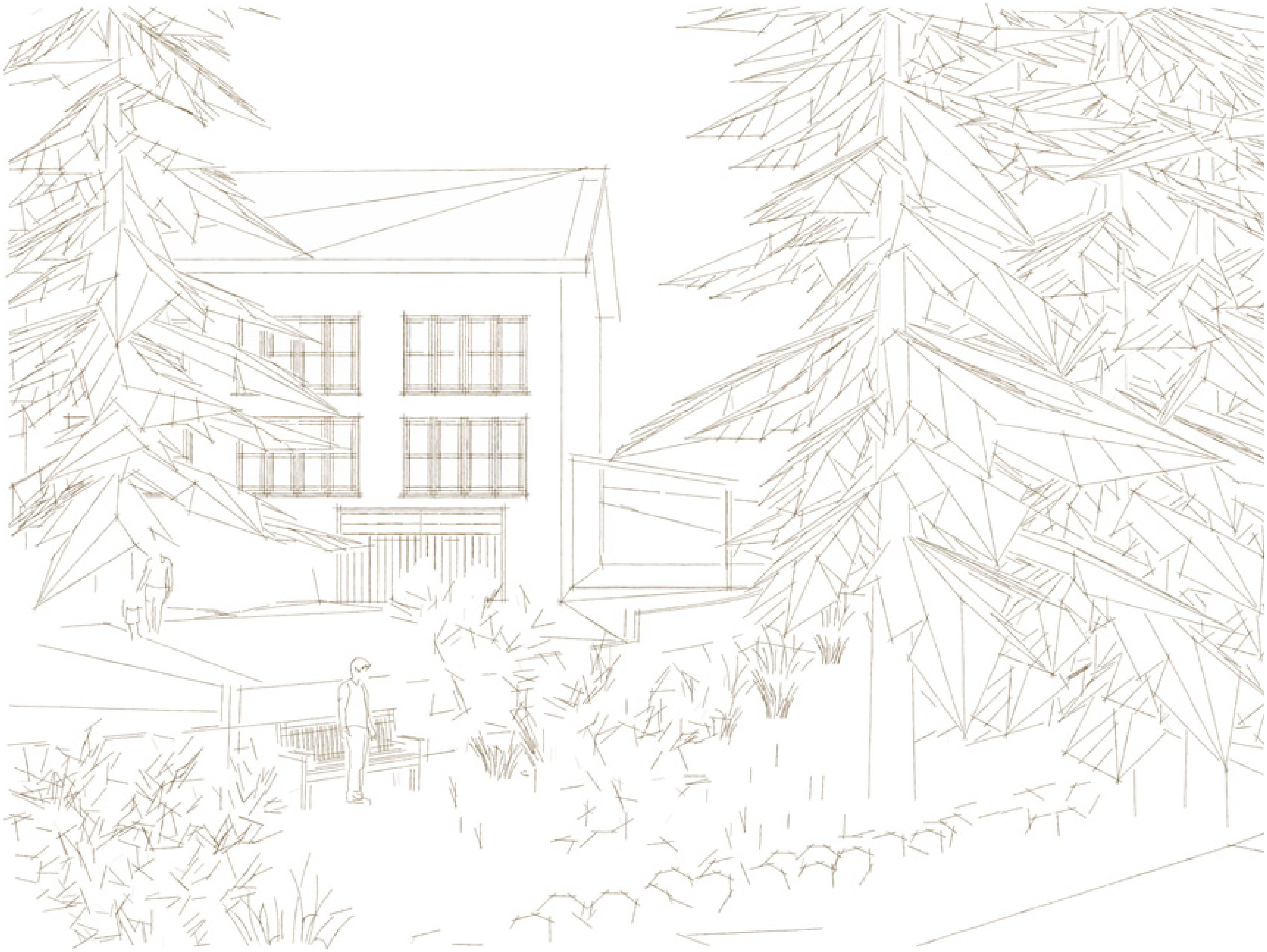


Fig. 6.5a Perspective Views

Fig. 6.5b Color Rendering of 3-D Model

Fig. 6.6 Perspective View

Fig. 6.7 Close-Up Perspective of Wildflower Meadow

Irrigation Plan

The project proposal includes the addition of two rainwater storage cisterns on either end of the property, adjacent to collecting structures. They will be piped into two separate irrigation controllers that have a split-valve with the county mainline water supply (as shown in the Irrigation Plan on the following page).

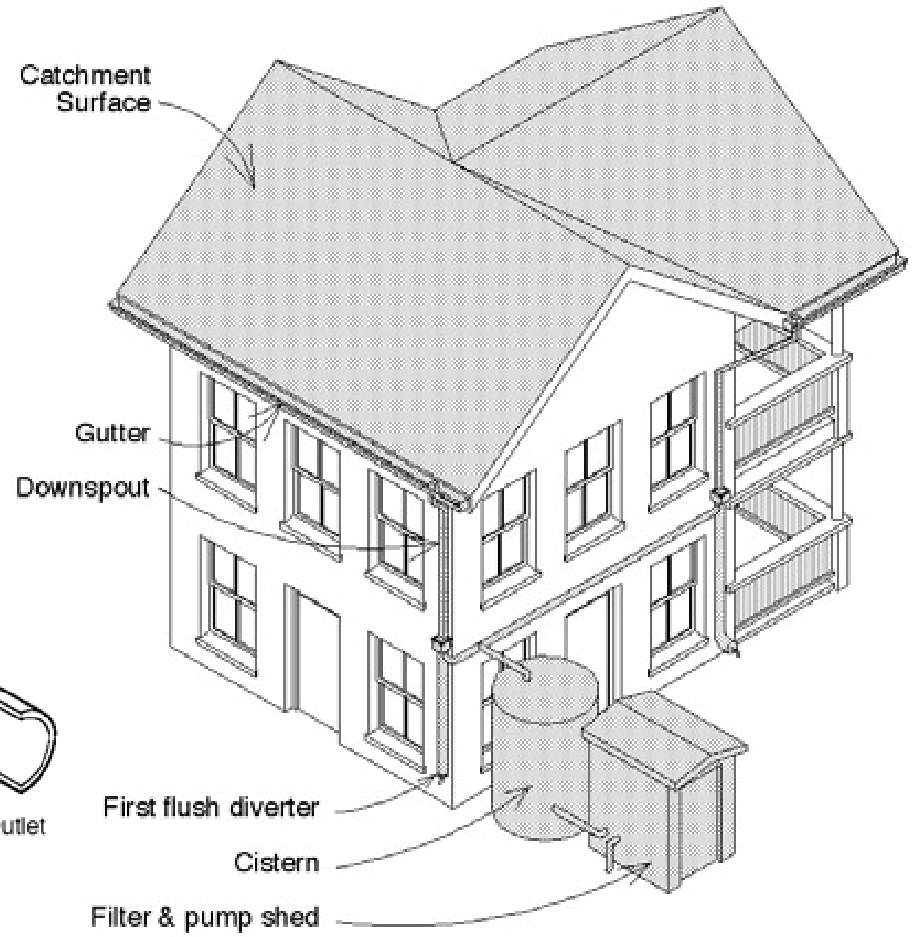


Fig. 6.8 General Rainwater Catchment System Diagram - taken from the Texas Manual on Rainwater Harvesting.

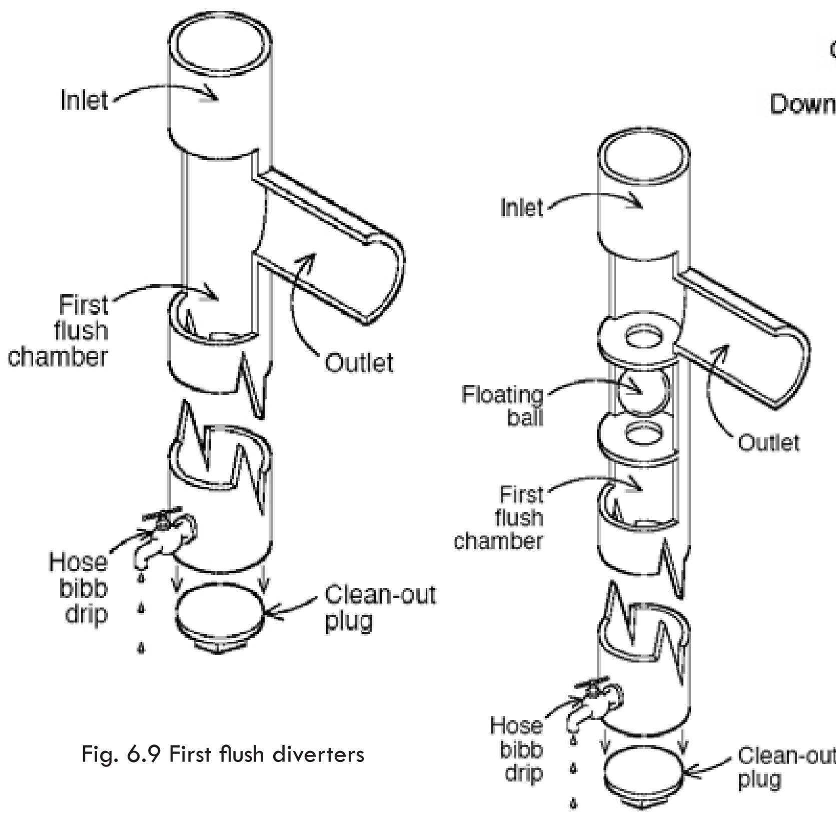


Fig. 6.9 First flush diverters

Irrigation Plan

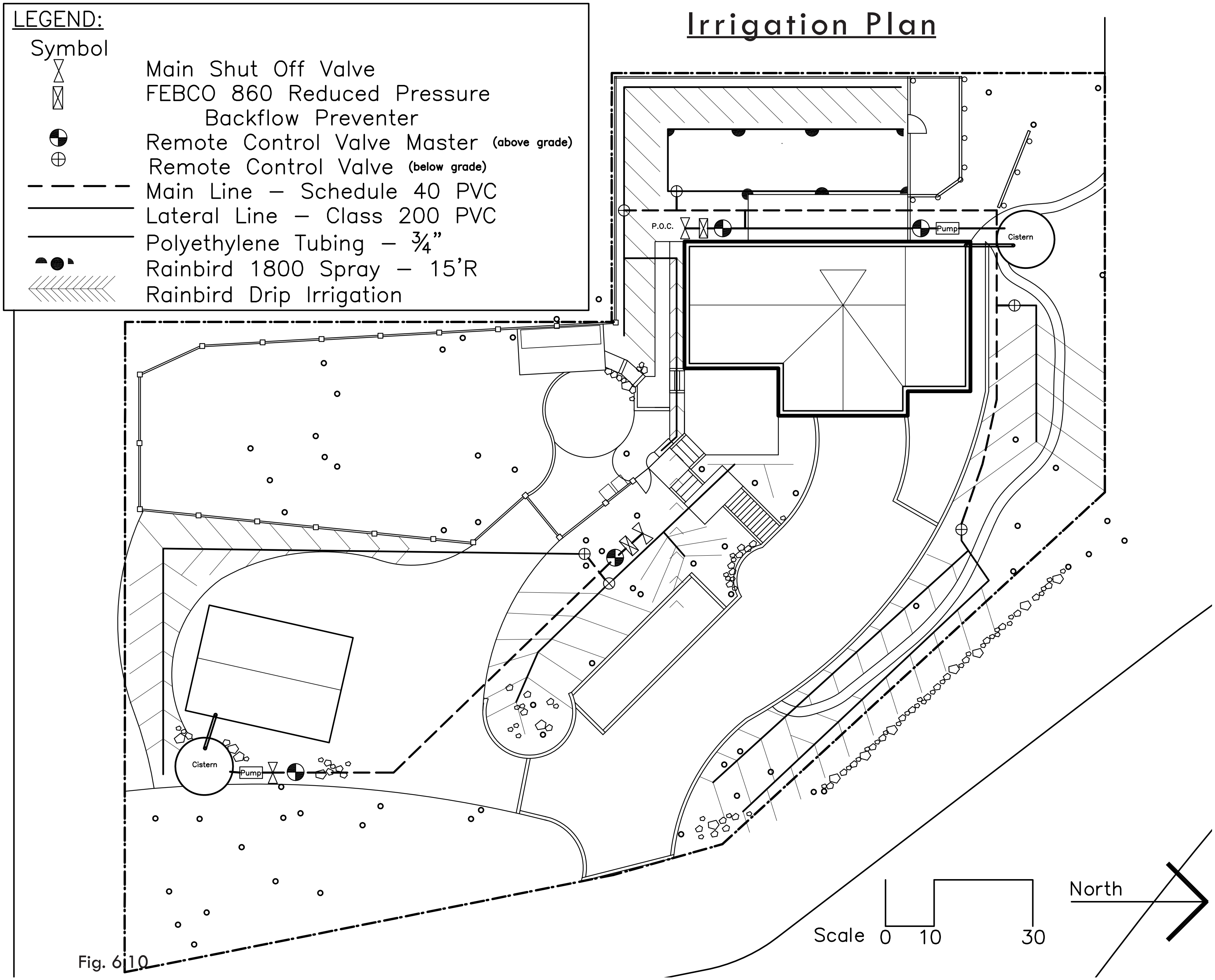


Fig. 6.10

Planting Plan

There are many purposes for planting a garden with plants native to your region, such as providing the requisite food and habitat for other native insects, birds and butterfly species that live there. The following list of plants includes a small sampling of the many plants native to California, with an emphasis on redwood-forest specific plants (a few non-native species are included if they meet other requirements of the site). Most of these plants require less water than non-native plants, and are adapted either to seasonal growth patterns that mimick the native climate, or have developed deeper rooting systems to withstand the annual period of summer drought in California. Once established they will require very little to no additional summer irrigation. These are tough plants that are also resistant to pests and diseases, as well as nutrient-poor soils, completely eliminating the need for toxic pesticides or fertilizers. It is recommended that they are planted with natural soil amendments such as compost or worm castings, as well as maintained with regular applications of surface mulch to keep down weeds and slow the evaporation of soil moisture.

The first priority for this site is to remove all of the invasive pest plants. These are non-native plants (mostly) that were introduced to the region and are having a negative effect on the native habitat and ecosystem functioning. As opposed to fostering a diversity of native species, many which have co-evolved relationships with native insects, these invasive plant species tend to overwhelm and outgrow the native plants. The following plants are invasives that should be removed:

Hedera helix	ivy spp.
Vinca major	periwinkle
Cytisus scoparius	scotch broom
Centaurea calcitrapa	purple star thistle

Beneficial insects are insects that do not eat plants, but are predators to other pest insects such as, aphids, mites, thrips, whiteflies, scale, leafminers and mealybugs. Some of the common beneficial insects that should be promoted and protected in the landscape include the following:

Dragonflies	eat mosquitoes
Ladybugs	eat aphids, mites, thrips, etc...
Green Lacewings	mites, thrips, aphids, etc.
Ground Beetles	eat soil-dwelling insect larvae
Damsel Bugs	aphids, leafhoppers, thrips, etc...
Hover Flies	many species of aphids
Soldier Beetles	aphids, grasshopper eggs, etc...

Planting Plan A:
Pollinator Garden

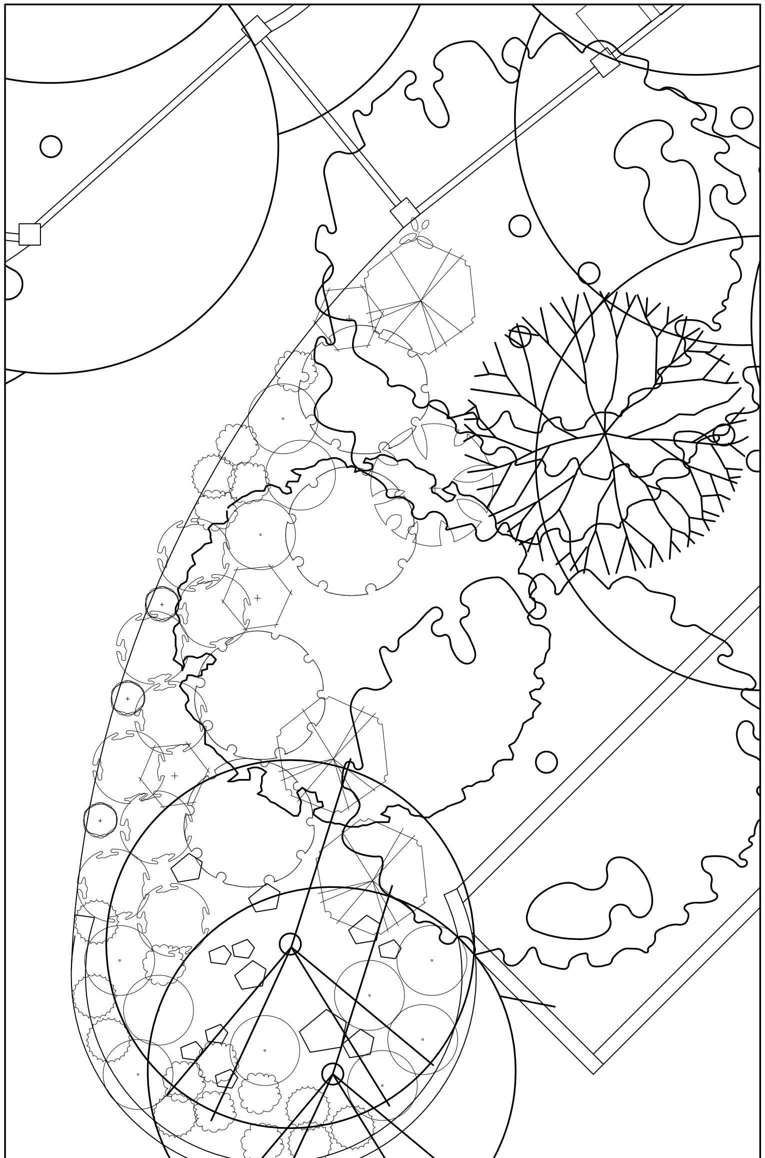
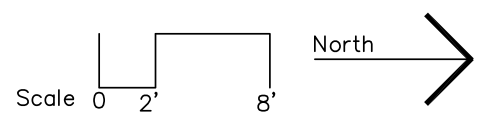


Fig. 6.11

LEGEND:

Symbol	Latin name	Common name
	(Existing)	
	Acer palmatum	Japanese maple
	Arbutus menziesii	madrone
	Lithocarpus densiflora	tan oak
	Sequoia sempervirens	coast redwood
	(Proposed)	
	Achillea millefolium	yarrow
	Ceanothus thyrsiflorus	blueblossom
	Lonicera hispidula	pink honeysuckle
	Mimulus aurantiacus	sticky monkeyflower
	Monardella villosa	coyote mint
	Penstemon heterophyllus	foothill penstemon
	Quercus agrifolia	coast live oak
	Rhodedendron occidentale	western azalea
	Romneya coulteri	matilija poppy
	Salvia clevelandii	Cleveland sage
	Wisteria sinensis	Chinese wisteria



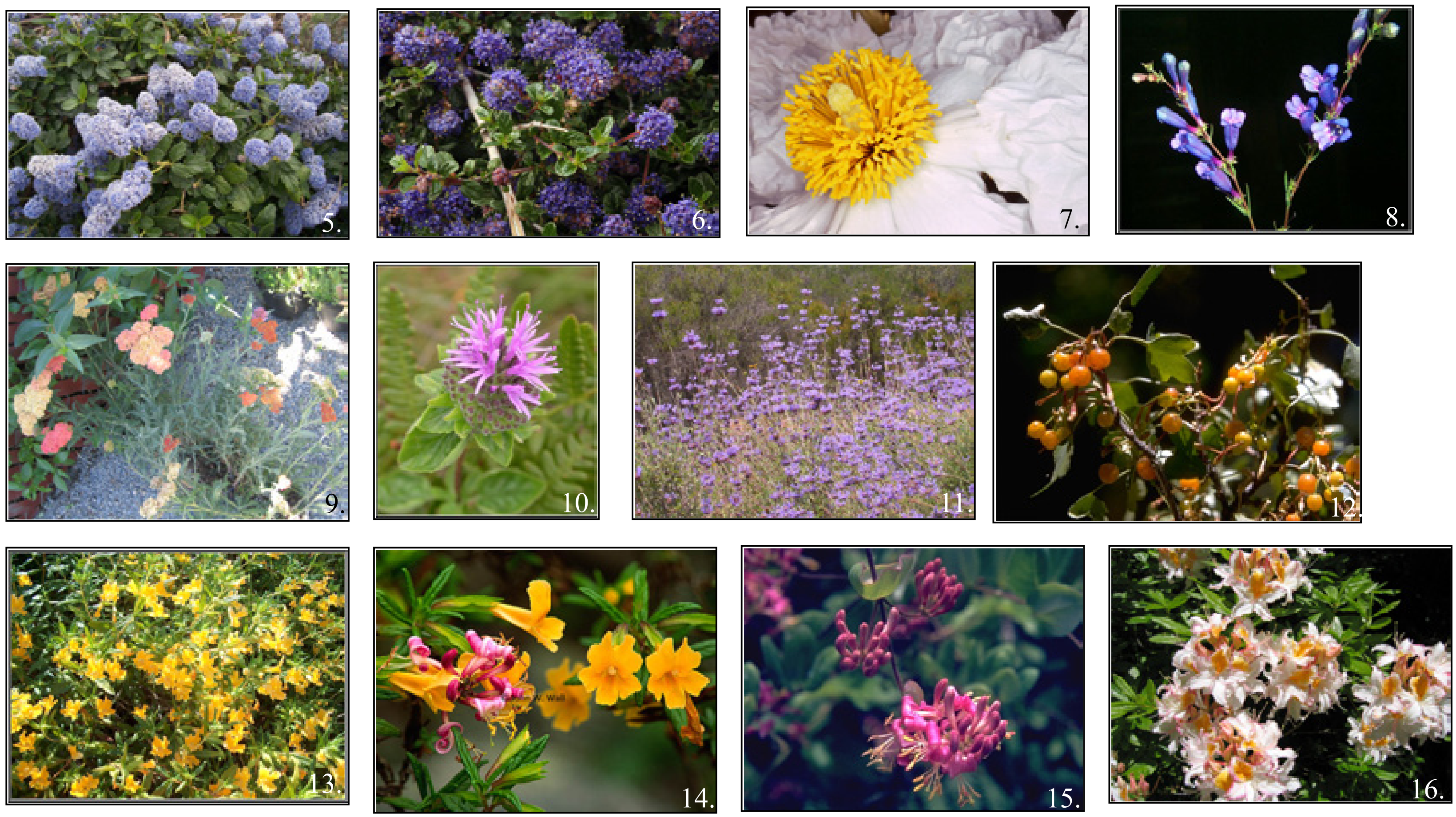


Fig. 6.12
Please refer to page 48 for species names

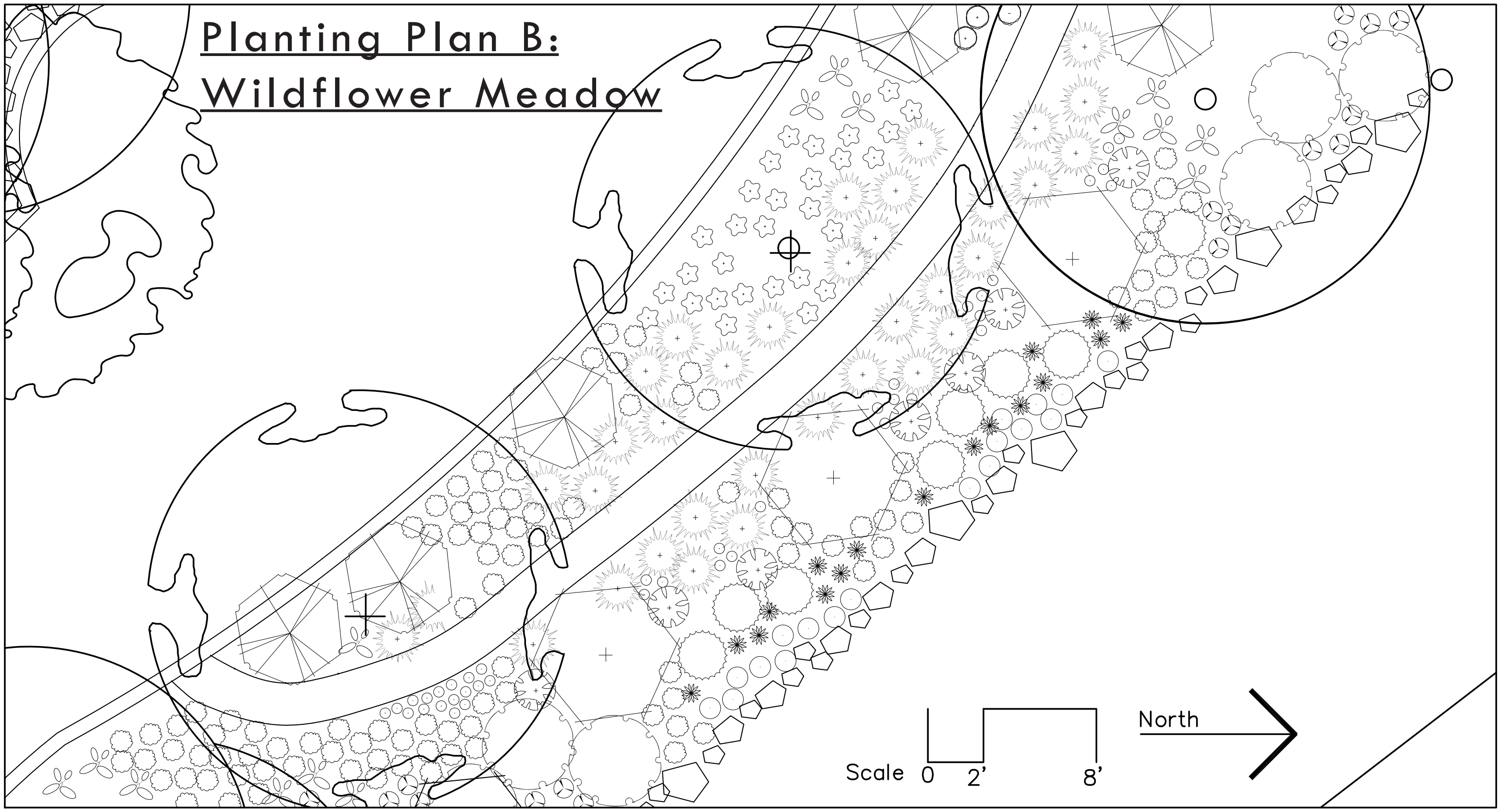


Fig. 6.13

LEGEND:

Symbol	Latin name	Common name
	(Existing)	
	Acer macrophyllum	bigleaf maple
	Corylus cornuta	CA hazelnut
	Dicentra formosa	bleedingheart
	Iris douglasiana	Douglas iris
	Oxalis oregana	redwood sorrel
	Polystichum munitum	western swordfern
	Sequoia sempervirens	coast redwood
	Trillium ovatum	western wakerobin
	Vaccinium ovatum	huckleberry

Symbol	Latin name	Common name
	(Proposed)	
	Aquilegia formosa	western columbine
	Asarum caudatum	wild ginger
	Calochortus albus	white fairy lantern
	Carex tumulicola	foothill sedge
	Lilium pardalinum	CA tiger lily
	Ribes sanguineum	redflowering current
	Salvia spathacea	hummingbird sage
	Satureja douglasii	yerba buena

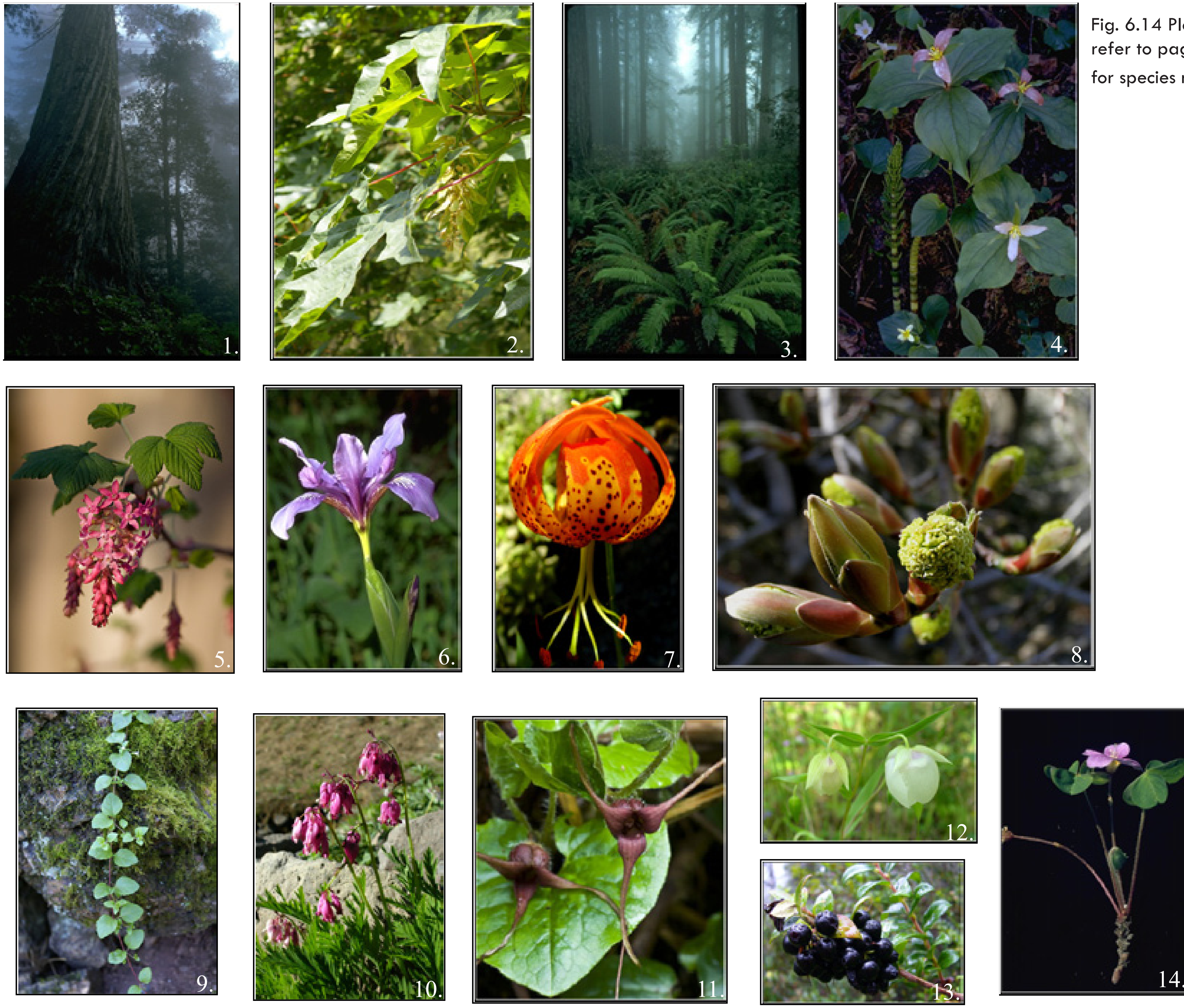


Fig. 6.14 Please refer to page 48 for species names

List of CA Native Plants for Sun-Loving Perennial Pollinator Garden

1.	Lithocarpus densiflora	tan oak
2.	Arbutus menziesii	madrone
3.	Quercus agrifolia	coast live oak
4.	Hierochloe occidentalis	sweet grass
5.	Ceanothus griseus	Carmel ceanothus
6.	Ceanothus thyrsiflorus	California lilac
7.	Romneya coulteri	Matilija poppy
8.	Penstemon heterophyllus	foothill penstemon
9.	Achillea millefolium	yarrow
10.	Monardella villosa	coyote mint
11.	Salvia clevelandii	Cleveland sage
12.	Ribes aureum	golden current
13.	Mimulus aurantiacus	sticky monkey flower
14.	Mimulus and Lonicera honeysuckle	sticky monkey and
15.	Lonicera hispidula	pink honeysuckle
16.	Rhododendron occidentale	western azalea

List of CA Native Plants for Shade-Loving Wildflower Meadow

1.	Sequoia sempermirens	coast redwood
2.	Acer macrophyllum	bigleaf maple
3.	Polystichum munitum	western sword fern
4.	Trillium ovatum	western wakerobin
5.	Ribes sanguineum	redflowering current
6.	Iris douglasiana	Douglas iris
7.	Lilium pardalinum	California tiger lilly
8.	Acer macrophyllum	bigleaf maple
9.	Satureja douglasii	yerba buena
10.	Dicentra formosa	bleeding heart
11.	Asarum caudatum	wild ginger
12.	Calochortus albus	fairly lantern
13.	Vaccinium ovatum	huckleberry
14.	Oxalis oregana	redwood sorrel

Local Materials

McNear Brick and Block Manufacturing Company located in San Rafael, CA is a local green manufacturing company in that they use ~40% recycled clay and shale content for their line of bricks that would otherwise be wasted in landfills. They have permeable cobblestones that are not made from recycled materials, but offer stormwater benefits, and impermeable pavers.

The work of local artists will be employed throughout the landscape, such as the creative organic forms of sculptor John Lamos of Sebastopol, CA.

Fig. 7.1 Cobblestone Pavers

Fig. 7.2 An example of a local installation of pavers

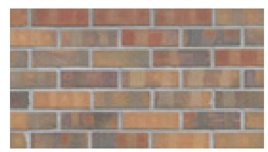


Fig. 7.3 Recycled-content Bricks

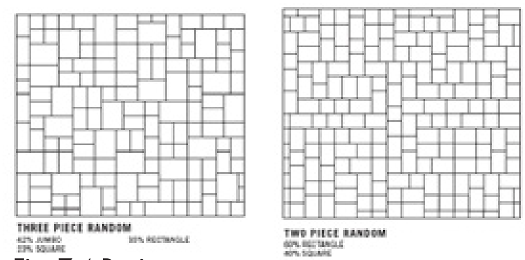


Fig. 7.4 Paving patterns

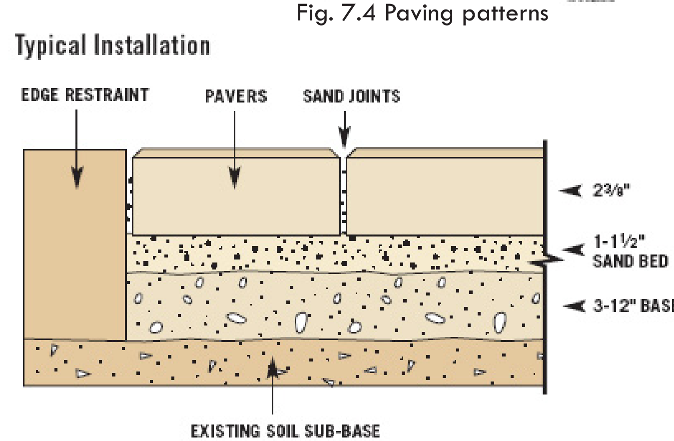


Fig. 7.5 Installation Detail

Fig. 7.6 Sculpture by Artist John Lamos, Sebastopol, CA

Stone for dry-stacked walls, veneer on concrete units, or as naturalized accent elements will be sourced from within the state of California, or western region of the United States, to reduce the environmental costs of trucking materials over long distances.

The rainwater storage cistern and other built elements will reflect the predominant colors and materials of the local environment by being made with salvaged or reclaimed Pacific-coast redwood and bound with steel cables.

Fig. 7.7 Reclaimed or salvaged redwood timber - McMullin Sawmill - Crescent City, CA


Fig. 7.8 Stone-veneered outbuilding


Fig. 7.9 Dry-stacked stone wall


Boquet Canyon boulder - Red Hills, CA


Desert Gold 3/8” gravel


CA Fieldstone boulder - Yosemite, CA

Fig. 7.10a, 7.10b, 7.10c

Fig. 7.11 25,000-gallon Timbertank in Central Texas - showing the rustic aesthetic appeal of wooden tanks.

Fig. 7.12a Water storage cistern made in Healdsburg, CA

Fig. 7.12b

Fig. 7.13 Round Cistern Capacity in Gallons

Height (feet)	6-foot Diameter	12-foot Diameter	18-foot Diameter
6	1,269	5,076	11,421
8	1,692	6,768	15,227
10	2,115	8,460	19,034
12	2,538	10,152	22,841
14	2,961	11,844	26,648
16	3,384	13,535	30,455
18	3,807	15,227	34,262
20	4,230	16,919	38,069

Conclusion:

Although this research did not result in a Picasso-like stroke of creative genius across a blank canvas, what it did do was work within a framework of bioregional design parameters to develop design solutions based on a variety of functional considerations. It was an enriching exploration into several of the important "layers" of information that are necessary for the successful planning of any place.

Not only was it a personally fulfilling venture to study the history and cultural identity of a place with which I am very close, and the ecosystems that have been functioning there for millions of years, but the process allowed for the design development to occur naturally. I realize that within a rich region such as this one, it is more a matter of allowing the biotic community to regenerate itself, and integrating the human functional uses into it with quiet strokes, as opposed to the other way around.

Just as the theory of bioregionalism suggests, with an increased knowledge of and sensitivity for the background and meaning of a project site, purposeful solutions are more likely to emerge. These solutions can often satisfy a wide range of requirements almost seamlessly.

This project is evidence of the theories of bioregionalism and ecological design in practice. The design proposal is woven into a rich tapestry of contextual relationships. Limitations were addressed and dealt with throughout the cyclical process of design evolution. Compromises were made throughout the process, and were essential to realizing the final results. The effects of this research are potentially far-reaching in the influence they will have on future design decisions and planning opportunities.

Bibliography:

1. Andrews, J. "Coastal Soul". Garden Design Magazine Nov./Dec. 2008: 84-91.

2. Berry, T. The Dream of the Earth. Sierra Club Books, 1990.

3. Bornstein, C., Fross, D., and O'Brien, B. California Native Plants for the Garden. Los Olivos, California. Cachuma Press, 2005.

4. B. Ellis and F. Bradley. The Organic Gardener's Handbook of Natural Insect and Disease Control. Rodale Press Inc., 1996.

5. Corbett, J., Anderson, C., Davis, D. & Stoner, P. The Ahwahnee Water Principles: A Blueprint for Regional Sustainability. The Local Government Commission, Sacramento, CA. 2004.

6. Francis, M. and Reimann, A. The California Landscape Garden: Ecology, Culture and Design. Berkeley and Los Angeles, California: University of California Press, 1999.

7. A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California. The landscape coefficient method and WUCOLS III (Water Use Classifications of Landscape Species). University of California Cooperative Extension. California Department of Water Resources, 2000.

8. Haskin, Andrew. A Guidebok to Rendering with SketchUp and PhotoShop. Senior Project, University of California Davis, 2007.

9. Jepson, W.L. The Jepson Manual of the Flowering Plants of California. University of California Press, 1953.

10. Kashiwagi, J.H. and Hokholt, L.A. Soil Survey of San Mateo County. USDA, Soil Conservation Service in cooperation with the Regents of the University of California Ag. Experiment Station, 1991.

11. Margolin, M. The Ohlone Way: Indian Life in the San Francisco - Monterey Bay Area. Berkeley, CA: Heyday Books, 1978.

12. McHarg, Ian. Design with Nature. Natural History Press, Garden City, New York, 1969.

13. Skyline: Santa Cruz Mountains Area Study. Department of Environmental Management, Planning and Development Division. San Mateo County, California, 1988.

14. Stanger, F.M. Sawmills in the Redwoods: Logging on the San Francisco Peninsula, 1849 – 1967. San Mateo County Historical Association, San Mateo, California, 1967.

15. Strom, S., Nathan K. and Woland J. Site Engineering for Landscape Architects. Haboken, New Jersey: John Wiley & Sons, Inc., 2004.

16. Thayer, R. LifePlace: Bioregional Thought and Practice. University of California Press, 2003.

17. Trevenon, S. Images of America: Kings Mountain. San Francisco, CA: Arcadia Publishing, 2008.

18. CalFlora database. http://www.calflora.org/

19. California Wildlife Habitat Relationships System Database, California Department of Fish & Game, version 2008.

20. Salmonid Habitat Restoration Planning Resource for San Mateo and Santa Cruz Counties. http://www.cfses.org/salmonid/index.htm

21. Midpeninsula Regional Open Space District. http://www.openspace.org/about_us/default.asp

22. USDA - NRCS Web Soil Survey. http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Photo Credits:

1.1 USDA - NRCS Web Soil Survey for San Mateo County. http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

1.2. Draft Peninsula Watershed Management Plan. April 1998. San Francisco Public Utilities Commission. http://sfwater.org/home.cfm

1.3 USGS http://3dparks.wr.usgs.gov/3Dbayarea/html/CrystalSprings.htm

1.4 USGS http://3dparks.wr.usgs.gov/3Dbayarea/html/CrystalSprings.htm

1.5 Midpeninsula Regional Open Space District. http://www.openspace.org/about_us/default.asp

1.6 Midpeninsula Regional Open Space District. http://www.openspace.org/about_us/default.asp

1.7 Midpeninsula Regional Open Space District. http://www.openspace.org/about_us/default.asp

1.8 County of San Mateo. www.co.sanmateo.ca.us

1.9 County of San Mateo. www.co.sanmateo.ca.us

1.10 County of San Mateo. www.co.sanmateo.ca.us

2.1 Geology Page. July 2004. Salmonid Habitat Planning Restoration Resource, National Oceanic amd Atmospheric Administration Coastal Services Center. 2004. < http://csc-s-maps-q.csc.noaa.gov/salmonid/html/water/geo.htm >.

2.2 Climate Page. July 2004. Salmonid Habitat Planning Restoration Resource, National Oceamoc amd Atmospheric Administration Coastal Services Center.

2.3 http://images.search.yahoo.com/images

2.4 http://images.search.yahoo.com/images

2.5a. California Wildlife Habitat Relationships System, California Department Of Fish And Game. Database Version: 8.2, 2008.

2.5b. California Wildlife Habitat Relationships System, California Department Of Fish And Game. Database Version: 8.2, 2008.

3.1 Margolin, M. The Ohlone Way: Indian Life in the San Francisco - Monterey Bay Area. Berkeley, CA: Heyday Books, 1978

3.2 The Palo Alto History project. http://www.paloaltohistory.com/ohlone.html

3.3 http://www.filoli.org/images/education/Native_Plants_Native_Ways.pdf

3.4 http://images.search.yahoo.com/images

3.5 Stanger, F.M. Sawmills in the Redwoods: Logging on the San Francisco Peninsula, 1849 – 1967. San Mateo County Historical Association, San Mateo, California, 1967.

3.6 Stanger, F.M. 1967.

3.7 San Mateo County History Page. July 2004. Salmonid Habitat Planning Restoration Resource, National Oceamoc amd Atmospheric Administration Coastal Services Center. 2004. < http://csc-s-maps-q.csc.noaa.gov/salmonid/html/people/mateo.htm>.

3.8 Stanger, F.M. Sawmills in the Redwoods: Logging on the San Francisco Peninsula, 1849 – 1967. San Mateo County Historical Association, San Mateo, California, 1967.

3.9 Stanger, F.M. Sawmills in the Redwoods: Logging on the San Francisco Peninsula, 1849 – 1967. San Mateo County Historical Association, San Mateo, California, 1967.

3.10 Trevenon, S. Images of America: Kings Mountain. San Francisco, CA: Arcadia Publishing, 2008.

3.11 Trevenon, S. Images of America: Kings Mountain. San Francisco, CA: Arcadia Publishing, 2008.

3.12 http://images.search.yahoo.com/images

3.13 History Page. 2004-2009. Midpeninsula Regional Open Space District. < http://www.openspace.org/about_us/our_history.asp>.

4.1 Site Analysis - map by author

4.2 Survey of Topography - map by author

4.3 Slope Analysis - map by author

4.4 Hydrozones - map by author

5.1 Current Outdoor Water Use - chart by author

6.1 Bubble Diagram - by author

6.2 Master Plan - map by author

6.3b Creating a TIN - model by author

6.3c Creating a TIN - model by author

6.4a Draping the Base Map - model by author

6.4b Draping the Base Map - model by author

6.4c Draping the Base Map - model by author

6.5 Rendering in SketchUp - digital artwork by author

6.5b Rendering in PhotoShop - digital art by author

6.6 Perspectives - digital artwork by author

6.7 Close-Up View - digital artwork by author

6.8 Texas Manual on Rainwater Harvesting, 3rd ed.

The Texas Water Development Board. Austin, TX, 2005.

6.9 Texas Manual on Rainwater Harvesting, 3rd ed.

The Texas Water Development Board. Austin, TX, 2005.

6.10 Irrigation Plan. - diagram by author

6.11 Planting Plan A - diagram by author

6.12 CalFlora database. http://www.calflora.org/

6.13 Planting Plan B - diagram by author

6.14 CalFlora database. http://www.calflora.org/

7.1 McNear Brick and Block Manufacturing Company

7.2 Local Installation of Pavers - authors own photo

7.3 McNear Brick and Block Manufacturing Company.

www.mcnear.com

7.4 McNear Brick and Block Manufacturing Company

7.5 McNear Brick and Block Manufacturing Company

7.6 Sculpture by John Lamos - authors own photo

7.7 McMullin Sawmill. www.sawemup.com

7.8 Stone Veneer - authors own photo

7.9 Dry-stacked Stone Wall - authors own photo

7.10a Lyngso Garden Materials. www.lyngsogarden.com

7.10b Lyngso Garden Materials. www.lyngsogarden.com

7.10c Lyngso Garden Materials. www.lyngsogarden.com

7.11 Texas Manual on Rainwater Harvesting, 3rd ed.
The Texas Water Development Board. Austin, TX, 2005.

7.12 10,000 Gallon Storage Cistern - authors own photo

7.13 Texas Manual on Rainwater Harvesting, 3rd ed. The
Texas Water Development Board. Austin, TX, 2005.