City of Palo Alto
Foothills Park Trails Maintenance Plan

January 29,2002

Prepared for
The City of Palo Alto
by
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Foothills Park – Trails Maintenance Plan
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1. Executive Summary

"*Trails should be left in as natural a state as possible with as little disturbance to the soil and vegetation as possible*"

City of Palo Alto Parks and Recreation Commission

January 29, 2002

In keeping with this Commission directive, the "*spirit of this plan*" is to look at trail maintenance activities from an environmental perspective, which will allow for natural processes to prevail.

1. Executive Summary

Setting

Foothills Park is located on the eastern slope of the Santa Cruz Mountains in the city limits of Palo Alto. It has a hilly, predominantly wooded terrain. Access into the Park is through the main gate located on Page Mill Road.

The park is comprised of 1,400 acres with fifteen miles of hiking trails. The existing 15 – mile trail system was developed almost forty years ago. Most of these trails are single track ranging in width from 18 inches to 5 feet wide. The longest, Los Trancos Trail is seven miles. The trail tread surface throughout the park is compacted native soil.

Trail use is limited to pedestrian-oriented activities including: hiking, running, dog walking (on leash), participation in interpretive/education programs (e.g. as part of the ranger programs, the youth day camps and "Friends" programs), bird watching and native plant studies.

Participation & Research

This handbook was developed as a reference tool, which can be used to supplement the knowledge of experienced field staff. It was written in consultation with park staff, the City Parks and Recreation Commission and community stakeholders.

Confirmation for the *Foothills Park Trails Maintenance Plan* objectives was provided at the September 25, 2001 Parks and Recreation Commission meeting. At that meeting that the Commission provided direction for preparing these trail maintenance guidelines. This direction called for "preserving the natural environment over developing highly engineered solutions which may protect the integrity of the trail" where a compromise between the two must be made. This direction provides a foundation for the recommendations provided in this handbook including the recommendations found in sub-section *Key Safety & Environmental Conditions Requiring Special Management*" described below.

At the January 29, 2002 Parks and Recreation Commission meeting, the commissioners approved this plan, restating their commitment to the preservation of the environment. The Commission emphasized that experienced field staff overseeing the California Conservation Corps work crews should use these guidelines when performing trail maintenance work. All trail maintenance work in Foothills Park should be performed in a manner that minimizes impacts to `the natural environment, keeping to the philosophy that "less is often better" when making decision about the on going maintenance of the trail system.

Research for the handbook included on-site investigations, literature review and phone conversations with other trail managers to compare current trail standards and maintenance practices for Foothills Park with local, state and national guidelines.

Refer to the *Section 8 - References and Contacts* for a list of sources and participants.

Objectives

The guiding philosophy for the Park is to "*provide for the use and enjoyment of the natural resources found in the park*". In keeping with this philosophy, the overall objective of this trail maintenance program is to provide "*clear passage*" throughout the trail system that will take into account:

- Visitor safety
- Resource protection
- The integrity of the trail system

Within the context of these general objectives, the plan addresses trail use, policies and procedures for conducting trail inspection and maintenance, and techniques for providing a clear passageway that are compatible with promoting the protection and appreciation of the Park's natural resources.

Americans with Disabilities Act (ADA) & Universal Access Assessment

While the City supports the concept of accessibility in outdoor environments, most of the trails in Foothills Park do not meet the desired accessibility goals with regard to trail steepness or width.

Therefore, this maintenance plan recommends that signs, brochures and other information that describe the trail system incorporate the Universal Trail Assessment System. This information system graphically describes existing trail conditions (such as cross-slope, grade, trail width, tread material, and obstacles) so that park visitors can make appropriate decisions regarding the use of the trails based on their skills and mobility levels.

The Trail Maintenance Program

The *Foothills Park Trails Maintenance Plan* provides maintenance guidelines for field staff to use when conducting their work tasks and when overseeing California Conservation Corps work crews and volunteer crews performing trail maintenance activities. This trail maintenance program includes recommendations for correcting damage or disturbance to the trail and to adjacent vegetation and slopes, but is not intended to alter the existing purpose,

intent, or design of the trail system. The trail maintenance program has eight major components. These components are summarized below.

Trail Maintenance in the Natural Setting- The recommendations in this handbook call for trail maintenance work to be undertaken in a manner that minimizes resource damage and efficiently utilizes on-site materials.

Visitor and Work Crew Safety - The recommendations in this handbook focus on safety – both from the user's perspective and from the perspective of the crews performing the work. Visitor safety is addressed by prioritizing the repair of those conditions that have the potential to be the most hazardous to the public. Guidelines for training crew leaders and work crews are provided *in Section 5 - Staffing*.

Structural Integrity of the Trail System – The guidelines in *Section 6 – Trail Maintenance Guidelines Techniques and Tools* identify conditions to watch for that have the potential to jeopardize the structural integrity of the trail system. This section also provides recommendations for correcting those conditions that are causing the most damage, or have the potential to cause the most damage, to the Park's unique natural resources.

The Trail Inspection - The recommendations in this handbook call for trail inspections to be conducted on a regularly scheduled basis. The frequency of the inspections will depend on the amount of trail use, the location, age, and types of structures, and the types of soil/terrain, but should occur at a minimum at the end of the rainy season. Refer to *Table 6-6 - Calendar of Trail Maintenance Activities* for a more detailed description of the timing of various maintenance activities.

The Maintenance Field Log - The recommendations in this handbook call for all trail inspections to be documented in writing in a field log. Information in the log should include documentation on the condition of railings, bridges, trail surfaces, proper and adequate signage, removal of debris and preparing trails for winter.

Setting Priorities - The recommendations in this plan focus on scheduling maintenance tasks, which will provide visitors with a relatively safe trail system that is not adversely impacting the surrounding natural environment. When establishing a work program, the first priority for trail work is to correct truly unsafe situations. This could mean repairing or closing trails where impassible washouts have occurred along a precipitous section of trail. The second priority is to correct conditions that are causing significant trail damage – erosion,

sedimentation and off-trail trampling. The third priority is to restore the trail to the design standards set forth in this handbook.

Annual Trail Maintenance - The annual maintenance program may include various corrective maintenance actions associated with tread maintenance, drainage maintenance, vegetative management, temporary closures, signing, monitoring and enforcement, or a combination of these methods as determined during routine inspections.

Cyclic Trail Replacement Projects – Routine construction, reconstruction, rehabilitation and restoration of trail structures (e.g. replacing signs, bridges, benches, steps) are considered cyclic or long-range projects. However, where major storm damage or vandalism occurs to these trail structures, it may be necessary to close that section of the trail and prioritize repair of those facilities that could endanger the public. Refer to the discussion on setting priorities above.

Staff Responsibilities

The foothills parks are staffed by rangers that are based out of the Foothills Park office. Park rangers are responsible for patrolling, monitoring and maintaining Foothills Park. They oversee the fieldwork of the California Conservation Corps (CCC) work program, as well as other the volunteer work programs at the Park. Rangers also lead guided nature walks and give nature slide shows. In addition, while the primary responsibility for fire and medical emergencies lies with the City Fire Department, rangers will typically be the first response team for fire and medical emergencies within the park.

Staff Training

This handbook recommends that all field employees be thoroughly trained to understand and be aware of all aspects of trail maintenance including, safety of staff work crews and visitors, and proper care of equipment and tools, as well as techniques for communicating with the public and volunteer work crews.

Techniques & Tools for Maintaining the Trails

The guidelines in *Section 6* of this trail maintenance handbook are intended to document practices that have been effective and to provide guidelines for correcting current trail deficiencies and damage from inappropriate management techniques. Additionally, these guidelines provide recommendations for monitoring and/or conducting special studies in areas with major environmental constraints and/or trail failures to minimize future impacts to sensitive resources.

Sub-sections 6.2 – 6.5 include descriptions, photos and illustrative diagrams showing typical conditions requiring routine corrective action and examples of

trail surface improvements. These examples include grading guidelines, drainage structures, bridges and steps, as well as guidelines for managing vegetation. In addition, a series of summary tables provide an overview of trail maintenance strategies within each of the vegetation communities found along the trail system. These techniques and tools are designed to protect the environment, as well as the user.

The trail maintenance program separates the trail into three components to clarify the limits of work for various maintenance activities. These components are described as follows.

- The *trail tread*, which is typically limited to a 2-foot (minimum) to 4-foot wide passageway that people actually travel
- The *trail bed*, which encompasses the trail tread, along with the soil "shoulder" and any subsurface improvements placed underneath and around the trail tread
- The *trail corridor*, which is an imaginary three-dimensional zone that includes the trail bed and areas above and to the sides of the trail. The *trail corridor* is the area in which most of the vegetation management activities take place, and is the area that provides the greatest potential for controversy over appropriate actions that should be undertaken to maintain a clear passageway.

Key Safety & Environmental Conditions Requiring Special Management

In addition to the tools and techniques provided to accomplish the routine maintenance activities required to keep the trail to a standard that meets the expectations of the field staff and the park visitors, there are a few conditions that will require special management. These include:

- Trail damage caused by both debris flows and deep-seated landslides
- Potential environmental damage that could occur from present or future maintenance practices along the Los Trancos Creek Corridor.

Recommendations for addressing *debris flow scars* include:

- Maintaining the trail in such a manner as to prevent water from collecting or ponding in the slide zone
- Avoiding cutting into the hillside to widen the trail bed
- Constructing slough containment walls and retaining walls to maintain a stable trail tread of adequate width for safe passage
- Monitoring trail conditions after high-intensity rain storms to see if additional slope movement has occurred
- Installing an interpretive sign about debris flows at the trailhead
- Discouraging access to trails with these conditions during the rainy season.

Recommendations for addressing the deep-seated landslide the Los Trancos Trail at the southern edge of the park in the short-term include:

- Immediately signing the trail as closed and blocking off the trail where it begins to parallel the creek well before it crosses the slide scar (approximately between Bridges 10 and 12)

Over the long-term, the City should review a variety of options for the deep-seated landslide along Los Trancos Trail with a registered geotechnical engineer including:

- Evaluating the site to determine if there are any remedial measures that could be undertaken to stabilize the trail bed
- Evaluating sites where an destination overlook could be developed to provide a scenic view and create a physical barrier to prevent further access into the area
- Evaluating remedial actions that might be undertaken to reduce future potentially adverse water quality impacts to Los Trancos Creek.

2. Introduction

The focus of these guidelines is to identify practical and realistic measures to minimize or avoid impact upon sensitive resources, while providing standards for maintaining open space trails that ensure a safe and pleasurable experience for all visitors.

2. Introduction

2.1 Trail Handbook Objectives

The *Foothills Park Trails Maintenance Plan* provides maintenance guidelines for field staff to use when conducting their work tasks and when overseeing California Conservation Corps work crews and volunteer crews performing trail maintenance activities. The focus of these guidelines is to identify practical and realistic measures to minimize or avoid impact upon sensitive resources, while providing standards for maintaining open space trails that ensure a safe and pleasurable experience for all visitors. The plan includes:

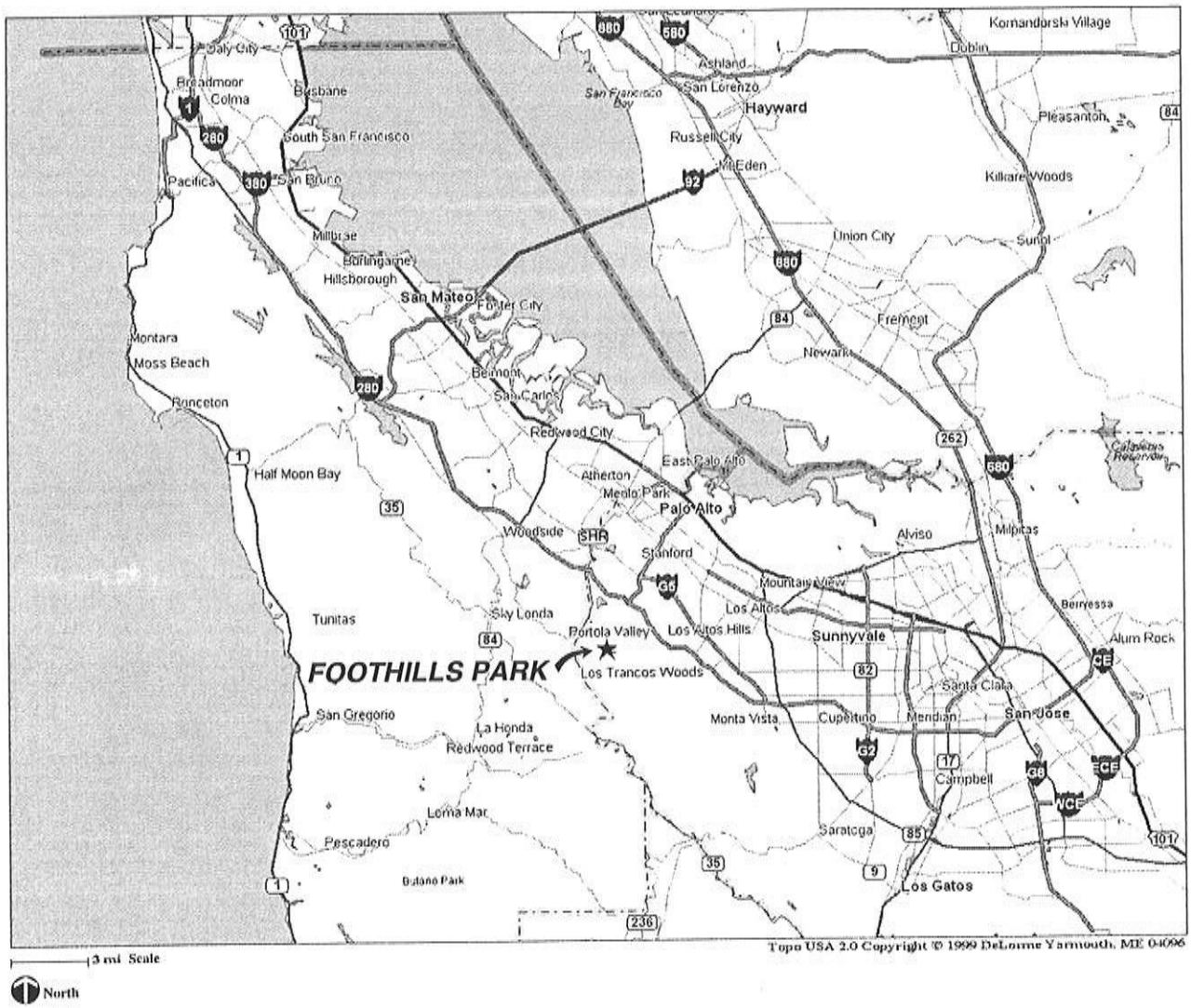
- Trail management objectives
- An environmental constraints analysis which takes into account the local topography, geology, climate, soils and vegetation of the park
- A trail maintenance program focused on addressing:
  - user safety
  - user expectations for resource protection and enhancement to provide a "natural experience"
  - available staffing

The maintenance techniques and tools included in this handbook are intended to provide guidelines for:

- Foothills Park administrative staff in developing staffing and budgeting priorities for trail management, maintenance and rehabilitation programs
- Field staff responsible for performing trail construction and maintenance activities
- Field staff responsible for overseeing the trail maintenance and vegetative restoration activities performed by the California Conservation Corps, the Friends of Foothills Park, a volunteer organization dedicated to the preservation of the native Californian ecology found within the park, and other volunteers

The handbook builds upon the extensive biotic and geologic research conducted by Franklin Olmsted, Friends of Foothills Park member, and input from the park staff, the City Parks and Recreation Commission and community stakeholders with an interest in the maintenance of the trails system and the protection of the unique native California ecology found within the park (refer to the acknowledgements for a complete list of participants).

The handbook has been written with the assumption that it will be used to supplement the knowledge of experienced field staff and that it will enable them to



Map 2-1 PARK LOCATION

operate more efficiently and make more informed decisions in budgeting future expenditures and in performing their daily work. This plan is not a construction manual, but it does include prototype design diagrams that can serve as a useful guide for performing routine maintenance tasks on existing trails and for rerouting or correcting trails with deficiencies.

This handbook does not substitute or replace any existing codes, rules or regulations of the City or the permitting agencies that may govern trail development, but is designed to complement them.

2.2 Park Setting

Foothills Park is generally located west of Interstate 280, east of Highway 35 (Skyline Boulevard), south of Alpine Road, and north of Page Mill Road. Access to the park is located off Page Mill Road in the foothills of the City of Palo Alto (See *Map 2-1 - Park Location*).

The western boundary of the park is along the San Mateo – Santa Clara County line. Arastradero Preserve, located to the north of Foothills Park, shares a common boundary for a short distance. Los Trancos Preserve (MROSD) and Foothills Preserve (MROSD) are located directly to the east and share a common border with the park. (See *Map 2-2 - Park Setting*).

The park is a total of 1,400 acres with an interpretive center, picnic areas, an overnight campsite, a dock at Boronda Lake and fifteen miles of hiking trails. The City purchased the property in 1958 on the condition that it be preserved as open space. The Park was formally dedicated in 1965 with the intent of preserving its open spaces in its natural state.

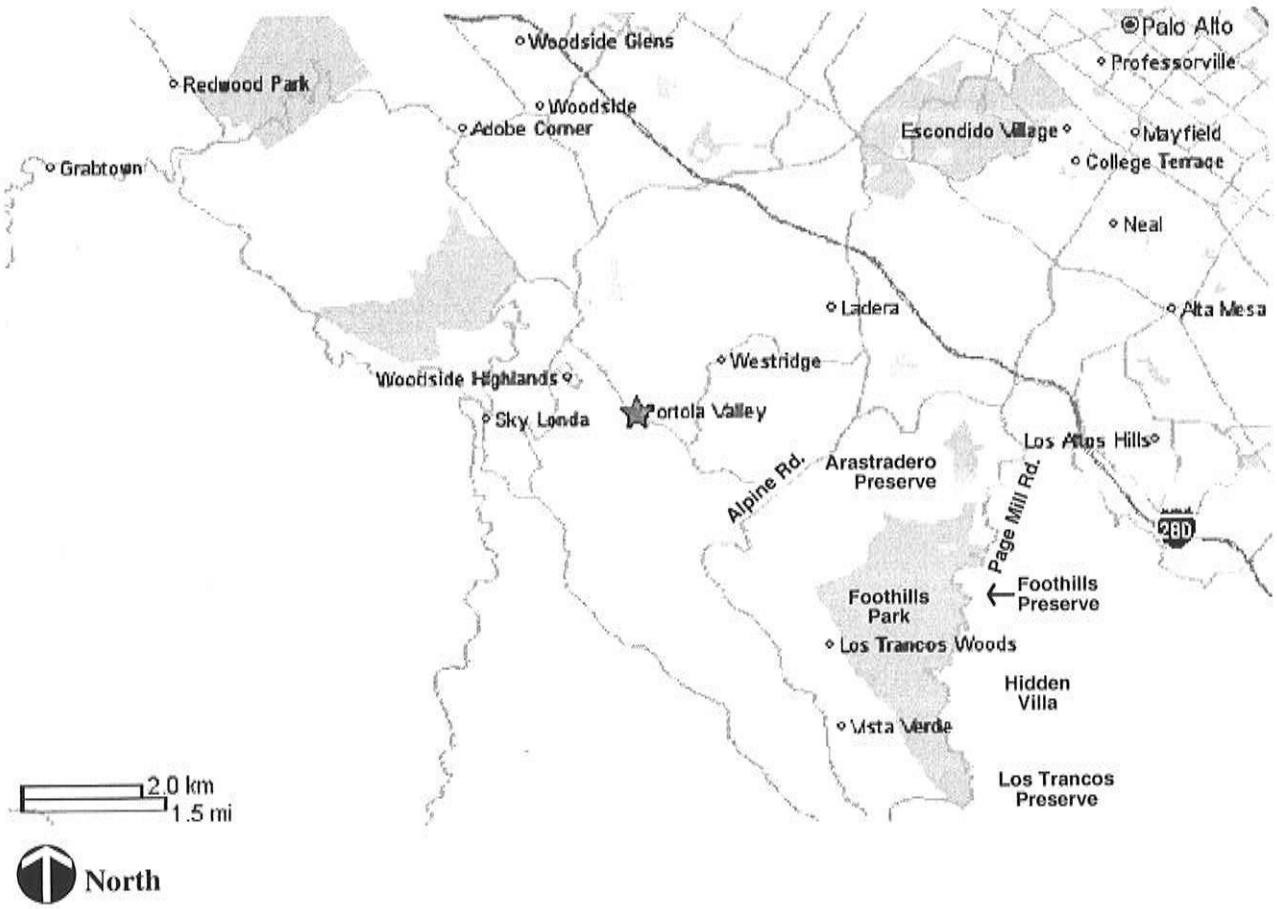
2.3 Use of the Park

Resident Policy (City Ordinance Title 22)

Because of the fragile nature of the ecology, the City has restricted admission to prevent overuse of the Park. Admission to the Park is limited to Palo Alto residents and their guests (15 people, 2 vehicles maximum) and regular, part-time and retired Palo Alto City employees. No more than 1,000 people can be in the park at any one time.

General Use Policy

Foothills Park is reserved for park, playground, recreation or conservation purposes.



Map 2-2 Park Setting

Trail Use

Trail use is limited to pedestrian-oriented activities including: hiking, running, dog walking (on leash), participation in interpretive/education programs (e.g. as part of the ranger programs, the youth day camps and "Friends" programs), bird watching and native plant studies.

Use of Bicycles and Other Coasting Devices

Bicycles can only be ridden on the asphalt-paved roads of Foothills Park. Skateboards, roller skates, coasters, blades or other coasting devices may not be used within the boundaries of the Park.

Dog Use

Dogs are only allowed in the Park on leash on weekdays. Dogs are not allowed on Saturdays, Sundays and holidays.

2.4 The Trail System

Access Points

Park Visitors – Main Gate

The only access into the park authorized by the Municipal Code is through the main gate on Page Mill Road. The main entry gate is identified as Gate 1.

Park Maintenance/Utility/Emergency (e.g. fire)

There are three other entry points off Page Mill Road that maintenance and emergency vehicles use to provide access from Page Mill Road. These are labeled as Gates 2, 3 and 4. Gate 2 provides access to the Charlie Brown firebreak and Toyon Trail. Gate 3 provides access to the Park Reservoir, a 1.5 million gallon city water reservoir. Gate 4 provides access to the Trapper's Fire Trail and to the southern portion of the Los Trancos Trail. In addition, utility vehicles and park maintenance/patrol vehicles wanting to access the Arastradero Creek Trail (Segment 3) within Arastradero Preserve enter Foothills Park and access this trail from Gate D. Gate D is located on the one-way road that leads from the Interpretive Center to Vista Hill in Foothills Park. There is also an access easement from Los Trancos Road in Portola Valley connecting to the service yard at the north end of the park. This easement is only accessible by park staff.

Local/Unauthorized Access

There are three common points where unauthorized visitors tend to enter the park. Gate 4 is a common location for illegal mountain bike activity, where users often ride down trails into Wildhorse Valley and Los Trancos Valley. Hikers in the Los Trancos Woods section of Portola Valley cross Los Trancos Creek to enter the park and hike on Los Trancos Trail. Arastradero Preserve users climb over Gate D on Vista Hill and hike on the Coyote Trail.

Of these illegal activities, mountain bike use on the trails from Gate 4 is of the most concern due to the potential to cause damage to the trail and hazards to hikers. The random occurrence of these activities and limited staffing available for patrols makes enforcement very difficult.

The Park Trails

The existing park trails system (See *Map 2-3 – Foothills Park Trail System*) consists of foot trails, maintenance roads, and firebreak trails.

Foot Trails

There are fifteen miles of hiking trails in the park. Most of these trails are single track, ranging in width from 18 inches to 5 feet wide. The longest, Los Trancos Trail is seven miles. The trail tread surface throughout the park is compacted native soil. Most of the trails include some barrier to accessibly including excessive grades (e.g. greater than 8.3%), steps, narrow widths with steep drop offs and significant obstacles (e.g. rock outcroppings, tree trunks extending into the trail).

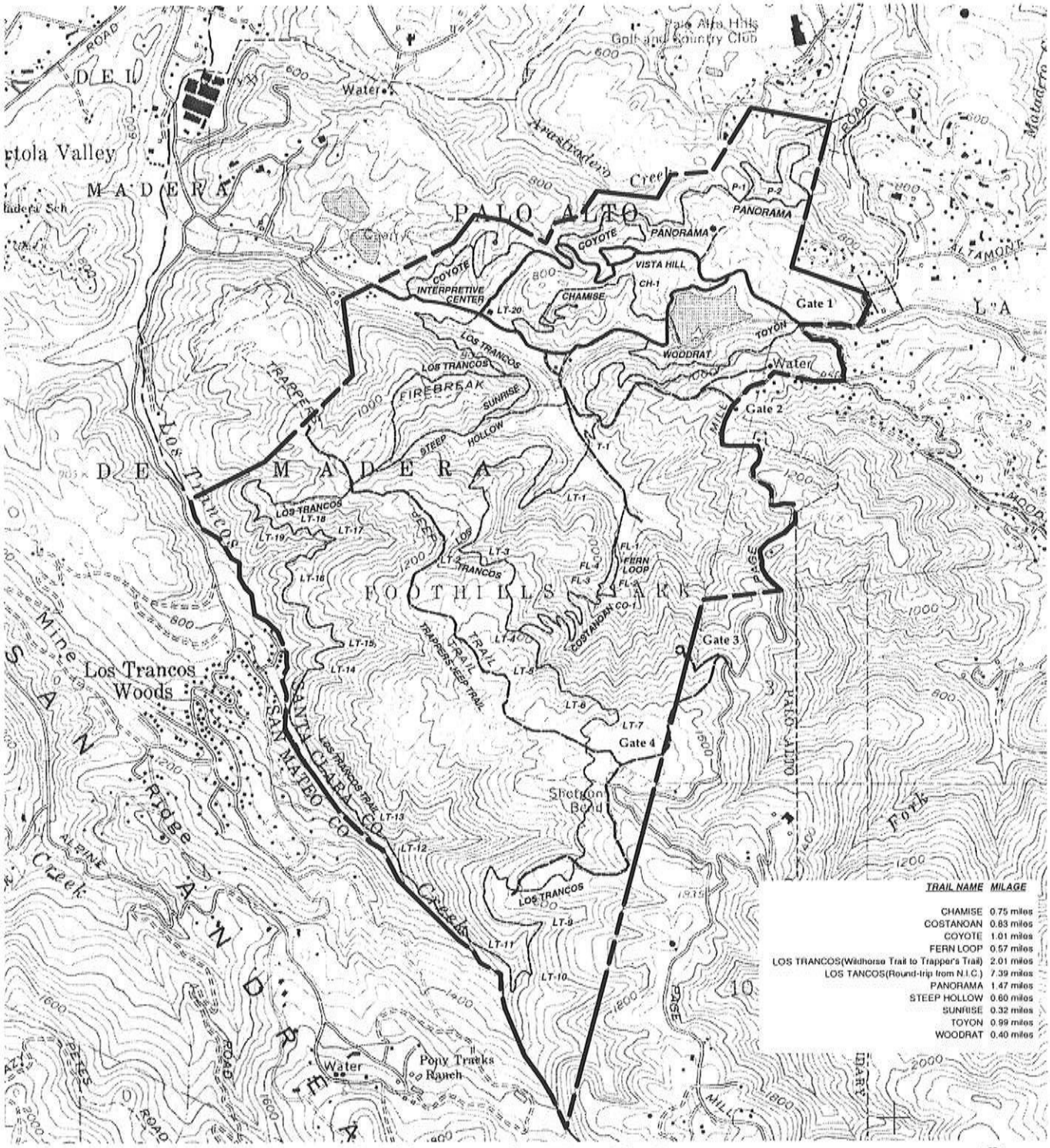
Maintenance Roads

There is only one "maintenance road" and that is the gravel road that leads from the Orchard Glen picnic area to Towle Campground through Wildhorse Valley/Las Trampas Valley. This road provides access to a utility pump station for the City of Palo Alto Utility Department and access to visitors using the Towle Campground. Hikers also use it as a trail connection (trailhead) to the Fern Loop Trail, Steep Hollow Trail, Los Trancos Trail and Toyon Trail.

Firebreak Trails – Fire Suppression Access Routes, Firebreaks and Evacuation Routes

Foothills Park is in a designated Hazardous Fire Area (HFA) because of the tremendous vegetation fuel load and the potential for extended response times in the event of a fire due to limited access/egress into the park. The area has also been designated as a Mutual Threat Zone (MTZ) by agreement with the California Department of Forestry and Fire Protection. This means that a fire within the City's jurisdiction is a threat to the State's jurisdiction and vice versa.

To meet the City's objective of *"reducing government costs and citizen losses from wildland fire by increasing initial attack success and or protecting assets at risk through focused prefire management objectives*" a fuel break system has been designed and implemented for Foothills Park. The main firebreak (by distance and location) is the Trapper's Firebreak Trail. It is two miles long, essentially running along the spine of the park. There are also several smaller breaks that are maintained as access roads for fire response. These branching firebreaks, which are located throughout the park, and the Trappers Firebreak Trail, are graded and compacted to a



Map 2-3 FOOTHILLS PARK TRAIL SYSTEM

width of 10 feet or greater to accommodate the City Fire Department's Type 3 and 4 vehicles. These firebreak trails have the potential to be reduced in width, or substituted with shaded fuel breaks if environmentally desirable. (A shaded fuel break allows annual grasses to return to the land, but not medium or heavy fuels.)

This configuration of the firebreak trails allows them to serve as connectors or unofficial short-cuts between established hiking trails. There are often no signs or markings where the fire breaks cross the trails to indicate the route of the firebreak. In addition to the firebreak trail network, "safety islands" have been identified in the park and an evacuation plan has been developed for the park. The primary evacuation route (as identified in the Palo Alto Comprehensive Plan) is Page Mill Road. The main road through the park connects to an access easement that provides an alternate evacuation route between Page Mill Road and Los Trancos Road.

Potential Connections to the Bay to Ridge Trail

The Bay to Ridge Trail through Foothills Park is proposed to provide a hiking link between the Bay Trail, which is located along the shoreline of the San Francisco Bay and the Bay Area Ridge Trail, which parallels Skyline Blvd. in the Open Space Preserves of Midpeninsula Regional Open Space District. The trail is intended to be open for year round use.

Foothills Park has the potential to provide a logical Bay to Ridge Trail connection between Arastradero Preserve and Los Trancos Preserve. The connection through the Park from the north would be from the Arastradero Creek Trail in the Arastradero Preserve. This potential connection is discussed in the Arastradero Preserve Trails Management Plan. The connection from the south would be from the Page Mill Trail in the Los Trancos Preserve, which is contiguous to the eastern boundary of the park.

Another alternative connection from Arastradero Preserve to the Bay Area Ridge Trail that has been considered would use the Coal Mine Ridge route and Los Trancos Road. This connection would also connect to Arastradero Preserve using the Arastradero Creek Trail that is discussed in the Arastradero Preserve Trails Management Plan. The connection from the southwest would be from the City of Palo Alto's maintenance easement through the Lee subdivision and from the City-owned, 7.7-acre parcel adjacent to the maintenance yard in Foothills Park. Hikers could travel through Foothills Park between these two connections using Coyote Trail. This route would then leave the park in a westerly direction and connect to Alpine Road.

A third alternative that has been tentatively considered in the past to limit access through Foothills Park is a new trail route that would parallel Page Mill Road. This

alternative would require extensive trail construction in a pristine area of the park that has very steep terrain. Therefore, this option is not explored in this trails maintenance plan because this option would:

- Duplicate an existing opportunity to connect to the Arastradero Preserve Trail and Los Trancos Preserve systems
- Have potentially significant environmental impacts resulting from new trail construction
- Would conflict with the Park objectives which call for *"minimizing potential environmental disturbance caused during construction by utilizing existing trails and correcting the deficiencies instead of building new trails"*.

Designation or development of any of these options for a regional hiking trail connection through Foothills Park would require modification of the present ordinances. Entry into the Park would need to be allowed at points other than the main gate. Unaccompanied non-residents would need to be permitted access through the Park. The Palo Alto Parks and Recreation Commission at its December 15, 2000 meeting tabled a discussion of a Foothills Park connection until it could be adequately publicized and discussed in greater detail.

Trail Amenities

Benches

Through the City's Adopt-a-Park program memorial benches have been installed throughout the park. A few of these benches have been installed along trails. The benches are purchased from a craftsman in Arcata California, and are constructed of recycled redwood with a bronze tribute plaque set in the bench's back.

Trash Receptacles

Trash receptacles are located at the picnic areas of the park. There are no trash receptacles or recycling containers along any of the park trails. There are two styles of trash containers in the Park. Some are wood clad containers with a hinged trap door, and some are stone-encrusted cement containers with metal tops.

Drinking Fountains

Drinking fountains are located near the front entrance of the park, at Boronda Lake, and in the Encinal, Pine Gulch, Orchard Glen and Oak Grove picnic areas, Some of the drinking fountains at Boronda Lake, Orchard Glen and the Oak Grove picnic areas are handicap accessible. There is also a drinking fountain in the Interpretive Center.

Signs

Trailhead signs for the Park are made of routed redwood. This standard has yellow painted routed letters. Font size is 1" to 2" for headers and 1" for text. Two redwood

4"x4" posts support the signs. Information includes the name of the trail and the mileage to the next trail junction. (Note: some signs include distances in kilometers. This nomenclature was added to signs for a brief period in the 1980's. Newer signs do not include kilometers).

The City of Palo Alto is developing a new sign program for trail markers along the route. It will generally follow the trail signage program developed for Poganip Park in Santa Cruz County. This standard has 6"x6" redwood posts with trail markers bolted in place that will show trail names, destinations and mileage. These signs will also include the distance back to the Interpretive Center.

Maps

A large map of the trail system in Foothills Park is posted on the wall in the Interpretive Center. Printed maps of the trail system are also available at the Interpretive Center. There are no maps at any of the trailheads or picnic areas in the park. Maps are available at the kiosk on Saturdays and Sundays. Maps are also located on the display board at Boronda Lake.

City staff is working with a graphic artist to design a new color map and activity guide for the park. This map will include information on accessibility (e.g. universal trail assessment factors, which include cross-slope, grade, trail width, tread material, and obstacles) and will identify each of the trail bridges by number.

Footbridges

There are 30 footbridges in the park. All of the bridges are constructed of wood members to blend with the natural surroundings. There are three basic styles. Bridge 1 is representative of recent California Conservation Corps trail work. It was built by the CCC in 1999 and should serve as a prototype for Type 1 bridge replacements in the future. The trail tread is flush with decking. The decking provides a firm footing. There are handrails (though handrails do not meet current standards for openings between railing members) which improve accessibility and safety at the crossing. Bridges 7 and 8 are typical of many of the bridges along the Los Trancos Trail. These bridges have a trail tread comprised of split rail logs, which are moss covered and very slippery in wet weather. There are no safety railings, though the drop off is typically more than three feet. The trail approach is generally aligned with bridge and flush with bridge decking. Bridge 9 represents a third style frequently used in the park. The wood decking provides a reasonable footing, though the decking is typically secured to the beams with nails rather than screws. There are no safety railings, though the drop off is often substantially more than three feet. The trail tread generally is not aligned with bridge, and the bridge decking is generally higher than trail tread,

Each of the trail bridges is identified with a number. These markers are 4" x 24" high, brown carsonite. The bridge number is in yellow.

Steps

The foot trails in the park incorporate steps in several locations where the terrain is very steep. A variety of wood and synthetic materials have been used in the past. The steps located along the Fern Loop Trail should serve as the prototype for future trail step replacement. These steps were constructed by the California Conservation Corps in 2001. The risers are made of "Trex", a recycled material composed of a mix of wood chips and polymer. The height of the risers is approximately 6 inches. The tread is compacted native soil fill. The steps are supported with rebar that is pounded below grade. The steps are designed to follow the contour of the trail.

Bike Racks

There are currently no bike racks in Foothills Park.

3. Management Objectives

"Habitat preservation is the primary goal, while providing for appropriate public access and activities. In instances where public access and activities conflict with the natural values of the Park, the preservation of the natural values of the Park shall prevail."

Policies and Proposals for the Trails and Paths Plan

March 1969

3. Management Objectives

3.1 Management and Operations Guiding Philosophy

In March 1969 the City adopted citywide *Policies and Proposals for the Trails and Paths Plan.* This set of guidelines was designed to serve as the general framework for developing trails and pathways in the City of Palo Alto. This Trails and Paths Plan incorporates habitat preservation as its primary goal, while providing for appropriate public access and activities. In instances where public access and activities conflict with the natural values of the Park, the preservation of the natural values of the Park shall prevail.

This City policy, which focuses on habitat protection, was the guiding philosophy that led to the purchase and subsequent decisions for developing and managing Foothills Park. This philosophy of *"providing for the use and enjoyment of the resources found here, consistent with its preservation*" is reflected on the dedication plaque found on the top of Vista Hill.

The management objectives presented below provide a general statement of purpose or intent. They represent the long-range direction for the trails maintenance program at Foothills Park and establish the framework for the program found in *Section 5- The Trail Maintenance Program* and the recommended tools and techniques provided in *Section 6 - Trail Maintenance Guidelines – Techniques and Tools.* These management objectives are goals, not standards, and will need to be applied on a case-by-case basis taking into consideration the unique environmental conditions of the site.

In keeping with the guiding philosophy for the park, and the direction from City staff, the City Parks and Recreation Commission and community stakeholders, the objectives for this *Foothills Park Trails Maintenance Plan* focus on maintenance practices for the trail system that are compatible with promoting the protection and appreciation of the Park's natural resources.

3.2 Park Use Objectives

User Experience

- Provide a high quality user experience including opportunities to experience nature, solitude, skill testing, and social interaction
- Maintain trails in a safe condition to assure that the trails are open and accessible to hikers year round, with no seasonal closures

- Maintain trails in such a condition that park rangers can quickly reach and evacuate visitors in distress or who are incapacitated.

Use Policy

To meet the intent of preserving the park's open space in its natural state, comply with the current use provisions in the City's Ordinance Title 22, which call for:

- Designating trails for pedestrian use only
- Limiting dog walking (on leash only) to weekdays
- Limiting bicycle riding to asphalt-paved roads
- Prohibiting use of any other kind of coasting device (except wheelchairs) in the park
- Limiting access to 1,000 people in the park at any one time.

3.3 Trail Maintenance Objectives

Developing Policies and Procedures for Conducting Trail Inspection and Maintenance

Trail maintenance practices at the park should focus on prioritizing the allocation of labor and hours to maintain the structural integrity of the existing trail bed*, while working to comply with the City policy to" "*carefully tend this park wilderness*". This objective can be accomplished by:

- Developing procedures for trail management (e.g. temporary and permanent closures, signing, monitoring and enforcement)
- Developing procedures for periodic, systematic inspections prior to initiating annual maintenance programs that will include: a pre-maintenance survey for sensitive biotic species; evaluation of potentially unstable slopes and overuse of trail segments; and examination of fabricated trail components (e.g. water bars, benches, handrails, signs)
- Developing resource management oriented policies and procedures for trail maintenance based on the findings of the periodic inspections according to the following order of preference:
  1) Retaining the trail as is if visitor safety and trail integrity will not be jeopardized
  2) Repairing/replacing a deficiency if the trail condition could cause injury to trail users or will create unsafe conditions
  3) Brushing side slopes to provide adequate horizontal and vertical clearance for visitors safety and comfort
  4) Rerouting and/or closing the trail if repair to the trail bed would require major engineering and would adversely impact the surrounding environment until such engineering and additional environmental study is completed.

* Refer to *Section 6 - Trail Maintenance Guidelines – Techniques and Tools* for the definition of this term

Techniques for Providing a Clear Passageway

The intent is to provide a clear passageway or trail tread* that offers a "*reasonably safe*" and pleasant experience for the trail user, while protecting the adjacent natural resources. Measures to accomplish this objective include:

- Retaining a trail bed of compacted, native soil
- Allowing naturally occurring leaf litter to remain within the trail bed to protect the integrity of the tread (e.g. serving to minimize erosion and minimize encroachment of non-native exotics), provided it is not creating a safety hazard (i.e. slippery wet leaves on steps or areas near ledges)
- Providing positive drainage that promotes sheet run off and minimizes standing water or channeling within the trail bed
- Selectively removing overhanging vegetation to provide adequate vertical clearance for adult hikers to pass safely and comfortably without striking their heads
- Routinely pruning/removing noxious plants (e.g. poison oak, star thistle) to provide adequate width for hikers to walk without brushing against these plants**
- Employing vegetation removal techniques and tools for clearing the trail bed that can be used with higher selectivity, thereby disturbing the environment less and providing fewer opportunities for non-native plants to invade. These techniques should be aimed at cutting or removing specific plants or plant species and limiting damage to plants that give Foothills Park it unique character. (Such techniques may include hand pulling and prying, trimming with hand tools, selectively mowing with weed whips, and biological controls)
- Reducing physical obstacles in areas where the side slopes are precipitous (e.g. tripping hazards at approaches to bridges, overly narrow trail tread)
- Incorporating safety features into the design of fabricated trail elements (e.g. providing handrails on bridges in areas where the crossing is hazardous)
- Providing rest areas (e.g. sitting logs/boulders, memorial benches) adjacent to the trail where the terrain will naturally allow and where they will enhance the visitor's park experience (e.g. view site, at the end of a steep grade).

* Refer to *Section 6 - Trail Maintenance Guidelines – Techniques and Tools* for the definition of this term

** Refer to *Section 4 - Environmental Setting- Noxious Plants* for a table and discussion of noxious plants

Americans with Disabilities Act (ADA) & Universal Access Assessment

The City supports the concept of accessibility in outdoor environments, provided that modifications are not made to the environment that would substantially alter the nature of the setting or the purpose of the facility (e.g. trail). In the case of Foothills Park, most of the trails do not meet the desired accessibility goals with

regard to trail steepness or width. Technical actions that would be required to make the trail system accessible would include widening the trail tread (which would require extensive cuts in areas of steep terrain), using imported surfaces on the trail surface and removing ground vegetation within the trail corridor. These actions would conflict with the primary purpose of the trail system, which is to provide the visitors the opportunity to experience the "natural setting" and could directly or indirectly cause substantial harm to the natural habitat or vegetation of Foothills Park. To give visitors an understanding of the park trail system so that they can make appropriate decisions regarding the use of the trails the City should:

- Provide signage, brochures or information that describes trail conditions for all the trails in the park using the universal trail assessment system (factors include cross-slope, grade, trail width, tread material, and obstacles).

3.4 Natural Resources Management Objectives Adjacent to the Trail

Habitat Protection

Develop a maintenance program for the areas immediately adjacent to the trails that "*emphasizes the protection/enhancement of amenities of the park and sensitivity to the fragile foothills ecology*" by:

- Protecting and avoiding the removal of legally protected plant and animal species (as listed by State or Federal government agencies)
- Minimizing impacts to habitat for endangered and sensitive species to avoid a "taking" (as defined by State or Federal government agencies)
- Preserving and protecting native vegetation by limiting its removal whenever feasible
- Avoiding when possible the removal of native plants which are unusual in Foothills Park or which do not recover well after maintenance activities. This includes species identified by the California Native Plant Society as sensitive. (Note: avoidance may not be feasible if the plant will cause bodily harm or injury to trail users or will create unsafe conditions)
- Retaining native vegetation except in areas where City personnel determine that plants are creating a fire or safety hazard, or where vegetation is located within the tread of routinely maintained roads, trails and designated firebreaks
- Leaving low growing and slow growing native shrubs and groundcover on the uphill and lower sides of the trail corridor, where feasible, so that invasive, non-native plants will have less opportunity to increase in extent and so existing native plants can continue to provide erosion control
- Controlling/removing invasive, non-native plant species through a variety of vegetation management techniques in keeping with these objectives

- Mitigating for any accidental plant damage using appropriate restoration techniques
- Minimizing potential harassment to nesting birds through pre-maintenance surveys
- Ensuring there are no impacts to jurisdictional wetlands
- Limiting use of the park open space areas to designated trails to prevent damage to the park's resources - off-trail use will only be for restoration activities that are approved by the City Superintendent of Open Space and Science
- Giving priority to correcting trail deficiencies over building new trails
- Using careful maintenance and construction techniques to minimize impacts adjacent to trail project sites
- Limiting trail maintenance activities to the area already disturbed by the trail or existing staging areas
- Limiting staging for trail maintenance activities to existing staging areas within the park.

4. Environmental Setting

Foothills Park contains several distinct plant communities. These communities also integrate with each other, resulting in a diversity of habitat types for wildlife. This section describes the ecology of Foothills Park, identifies potential environmental impacts and provides recommendations to prevent or reduce impacts associated with trail maintenance activities on sensitive plant and animal species, nesting wildlife, soils (through erosion), and cultural resources.

4. Environmental Setting

4.1 Regional

Foothills Park is located on the eastern slope of the Santa Cruz Mountains in the city limits of Palo Alto. It has a hilly, predominantly wooded terrain. Elevations in the park range from about 600 feet above mean sea level (msl) to 1800 feet msl. The park is generally located west of Interstate 280, east of Highway 35 (Skyline Boulevard), south of Alpine Road, and north of Page Mill Road. Adjacent land uses are City Open Space Preserve (Arastradero Preserve), regional open space owned and managed by the Midpeninsula Regional Open Space District, private open space, and residential.

4.2 Plant Communities in Foothills Park

Foothills Park contains several distinct plant communities. These communities also integrate with each other, resulting in a diversity of habitat types for wildlife. The communities are described as follows, based on Thomas (1961), and are shown on *Map 4-1 - Plant Communities in Foothills Park.*

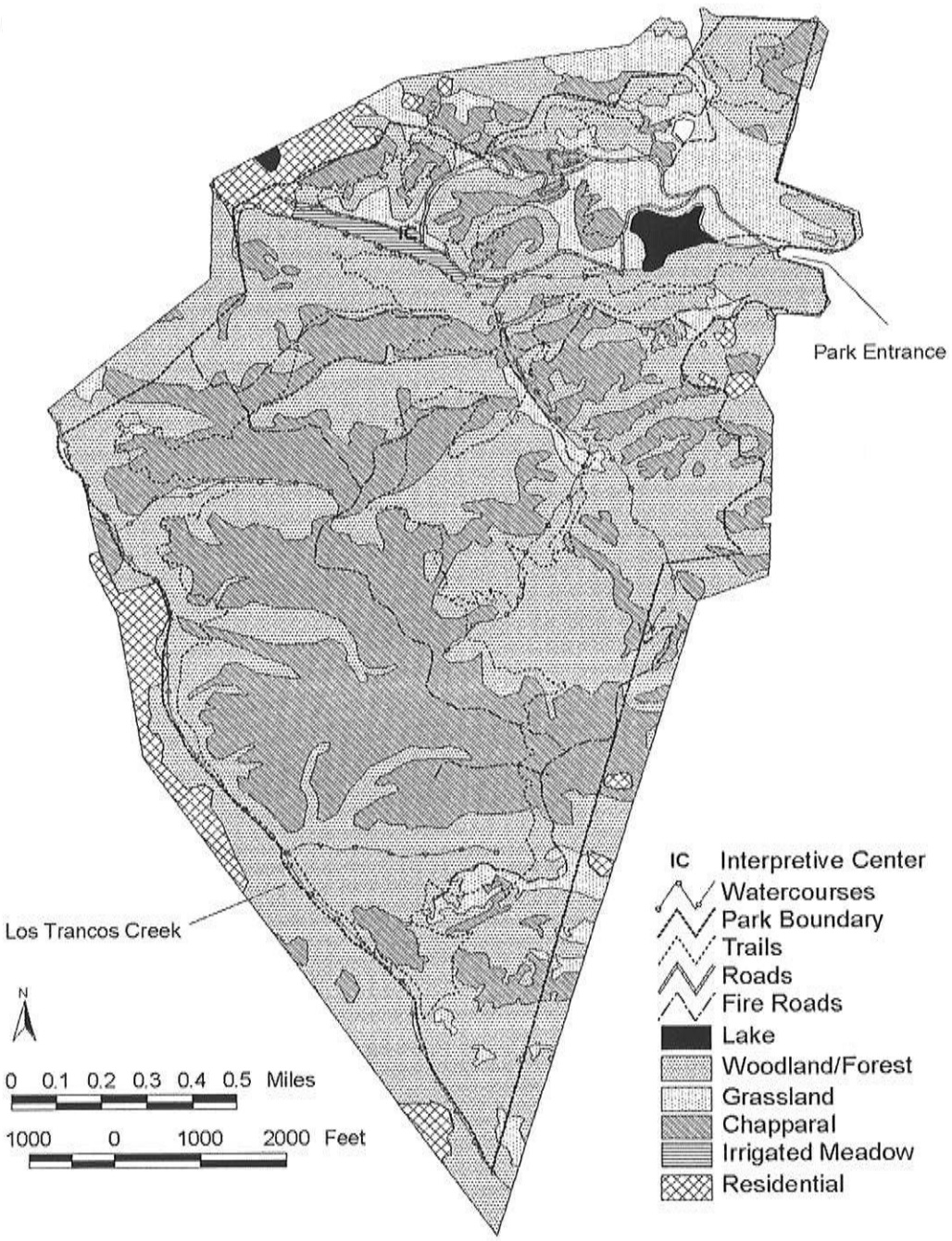
The woodland that covers a large portion of Foothills Park is a combination of foothill woodland and mixed evergreen forest. While the drier slopes tend to be dominated by foothill woodland species, the cooler east facing slopes tend to contain the combination of species described as mixed evergreen forest, but it all forms a continuous woodland canopy. In the ephemeral drainages and along the creeks the woodland tends to become dominated either by California bay laurel trees (*Umbellularia californica*), or by species noted below under Streamside Vegetation. Most of the tails are in woodland or chaparral *(Table 4-1 - Plant Communities by Trail and Appendix C- Map of Foothills Park Showing Distribution of Major Vegetation Types).*

Foothill Woodland

This community is dominated by several oaks (coast live - *Quercus agrifolia*; interior live - *Q. wislizenii*; valley - *Q. lobata*; black - *Q. kelloggii*; blue - *Q. douglasii*; gold - *Q. chrysolepis*), and also includes California bay, toyon (Heteromeles arbutifolia), poison oak (*Toxicodendron diversilobum*) and California buckeye (*Aesculus californica*). It may be relatively dense or rather open and form an oak savanna, which has an understory of grassland species. In Foothills Park, foothill woodland is dominant on the drier slopes. Coast live oak is the most common oak species, but the woodland also contains dense stands of gold oak and blue oak.

Mixed Evergreen Forest

The representative species in this community are coast live oak, interior oak, madrone (*Arbutus menziesii*), California bay, and big-leaf maple (*Acer macrophyllum*). Understory species include ferns (*Adiantum, Polypodium, Pityrogramma, Dryopteris, Pteridium*), snowberry (*Symphoricarpos mollis*), solomon's seal (*Smilacina* spp.), and several others.



Map 4-1 PLANT COMMUNITIES IN FOOTHILLS PARK

Several canyons in the park with cooler exposures support nearly pure stands of California bay laurel which, because of the chemistry of its leaves, tends to have no understory. Examples of this habitat are found in the drainages along the Los Trancos Trail.

Oak Savanna

See foothill woodland. Oak savanna is predominantly grassland with scattered species common in foothill woodland, primarily oaks such as live oak and valley oak.

Streambank Vegetation

As Thomas notes, "Small streams usually do not have floras conspicuously differing from those on the adjacent slopes." This is certainly the case in Foothills Park, which does not contain particularly distinct riparian zones. The exception may be Los Trancos Creek, which supports a more diverse stand of riparian trees than other drainages in the park. The stream habitat along Los Trancos Creek in the park at present consists of a deeply incised rocky channel with an overstory of primarily maples (*Acer macrophyllum*), alder (*Alnus* spp.) and little understory vegetation. High stream flows occurred in 1998, which may have cleared out the understory vegetation. Understory species expected in this community includes species such as thimble berry (*Rubus parviflorus*), elk clover (*Aralia californica*), blackberry (*Rubus ursinus*), and dogwood (*Cornus glabrata, C.californica).*

Chaparral

This plant community is common in Foothills Park, covering most of the drier slopes. It forms ecotones with foothill woodland, mixed evergreen forest and grassland. Common species in the chaparral are chamise (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos tomentosa* ssp. *crustacea*), Toyon (*Heteromeles arbutifolia*), scrub oak (*Quercus berberidifolia*), Mountain mahogany (*Cercocarpus betuloides*), Hollyleaf cherry (*Prunus ilicifolia*), poison oak, coffee berry (*Rhamnus californica*), red berry (*R. crocea*), Buckbrush (*Ceanothus cuneatus* var. *cuneatus*), Jim bush (*Ceanothus oliganthus* var. *sorediatus*), and Chaparral pea (*Pickeringia montana*).

Grassland

The grassland in Foothills Park occurs along the eastern boundary along the Panorama Trail and in patches at higher elevations next to foothill woodland, mixed evergreen forest and chaparral. It is dominated by non-native grasses such as oatgrass (*Avena* spp.), chess (*Bromus* spp.), fescues (*Festuca* spp.), and rye (*Lolium multiflorum*), but also contains native grasses including three-awn (*Aristida* spp.), poa (*Poa* spp.), and needlegrass (*Nassella* spp.). In several places the grassland contains infestations of yellow star thistle (*Centaurea solstitialis*), a non-native, invasive species which causes damage to the ecosystem (see the discussion of noxious plants, below).

Fresh-water Marsh

This plant community is found around the edges of Boronda Lake in the park. It is dominated by cattails (*Typha* sp.), but may also include plants such as tule (*Scirpus* sp.), buttercup (*Ranunculus* spp.), and smartweed (*Polygonum* sp.).

Irrigated Meadow

This is a meadow that extends most of the length of Wildhorse Valley in front of the Interpretive Center. This non-native grass meadow this is irrigated and mowed.

Table 4-1 Plant Communities by Trail

TRAIL	PLANT COMMUNITIES PRESENT
Chamise	foothill woodland, chaparral, grassland
Costanoan	foothill woodland, mixed evergreen forest, chaparral
Coyote	foothill woodland, oak savanna, chaparral, grassland
Fern Loop	foothill woodland, mixed evergreen forest, and chaparral along most of trail, grassland where trail is in the base of the valley
Los Trancos	foothill woodland, mixed evergreen forest, chaparral, grassland, streambank vegetation
Panorama	foothill woodland, chaparral, grassland
Steep Hollow	mixed evergreen forest, chaparral, grassland
Sunrise	foothill woodland, chaparral, grassland
Toyon	mixed evergreen forest, chaparral
Trappers	foothill woodland, chaparral, grassland
Woodrat	foothill woodland, mixed evergreen forest

4.3 Water Resources in Foothills Park and Downstream

Foothills Park is in the watersheds of Los Trancos Creek and Arastradero Creek. It contains the headwaters of Arastradero Creek and is just downstream of the headwaters of Los Trancos Creek. Los Trancos Creek leads to San Francisquito Creek, which empties into San Francisco Bay. Arastradero Creek flows to Page Mill Road, where it enters Matadero Creek and eventually empties into San Francisco Bay.

Los Trancos Creek in the park supports streamside vegetation and remains in a natural state. It contains pools and riffles of clear cold water which provide habitat for Steelhead trout, which migrate up the San Francisquito drainage from the San Francisco Bay. The steelhead run in the San Francisquito Creek watershed, including Los Trancos Creek, is listed as Threatened by the federal government and is protected under the auspices of the National Marine Fisheries Service. Los Trancos Creek is an important resource in the San Francisquito Creek watershed because of the cool, clear water habitat that it provides. Other drainages in the watershed are more heavily impacted by sediment and obstructions (e.g. bridges, drain pipes) in the creeks.

Los Trancos Creek is also habitat for the California red-legged frog. It may contain breeding habitat, and it may provide a corridor of travel between robust populations of California red-legged frog west of the crest of the Santa Cruz Mountains and populations known in and near Los Trancos Creek on the east side of the mountains.

Foothills Park contains four tributary drainages to Los Trancos Creek, which are marked as bluelines on the USGS map. Three of these are unnamed and are on the southwest side of the park and are crossed by the Los Trancos Trail. The fourth, named Buckeye Creek, is the drainage

through Wildhorse Valley and Las Trampas Valley. This drainage is fed by Boronda Lake and drainages along the Woodrat, Los Trancos, Fern Loop and Costanoan trails.

Arastradero Creek originates at the border of Foothills Park, just east of the Panorama Trail. It flows east through Arastradero Preserve where it fills man-made John Sobey Pond and man-made Arastradero Lake before heading downstream to join Matadero Creek at Page Mill Road. It has been channelized and culverted downstream of Arastradero Preserve. Matadero Creek has also been channelized through Palo Alto, but the stretches just downstream of the confluence of Arastradero are in a natural state. Matadero Creek is not known to currently support a population of steelhead trout but, does contain California red-legged frog downstream of the confluence with Arastradero Creek.

Foothills Park also contains a man-made lake called Boronda Lake. The lake was stocked with 1,500 fish in the summer of 1999, including catfish, red-eared sunfish, and bass, under a California Department of Fish and Game permit. It also contains bull frogs. Wetland vegetation around the lake is dominated by cattail (*Typha* sp.), which forms small areas of cattail marsh.

Animal Species in Foothills Park

Representative mammal species are listed in *Table 4-2- Mammals of Foothills Park*, and representative bird species are listed in *Table 4-3 - Birds of Foothills Park.* The diversity of vegetation types, connection with other open space and general undisturbed nature of the park contribute to its quality as wildlife habitat.

Table 4 - 2 Mammals of Foothills Park

Common Name	Scientific Name
Broad-footed mole	*Scapanus latimanus*
Shrew mole	*Neurothrichus gibbsi*
Shrew	*Sorex sp.*
Myotis bat	*Myotis sp.*
Mexican free-tailed bat	*Tadarida mexicana*
Racoon	*Procyon lotor*
Striped skunk	*Mephitis mephitis*
Gray fox	*Urocyon cinereoargenteus*
Coyote	*Canis latrans*
Bobcat	*Lynx rufus*
Mountain lion	*Felis concolor*
California ground squirrel	*Spermophilus beecheyi*
Merriam chipmunk	*Eutamias merriami*
Western gray squirrel	*Sciurus griseus*
Fox squirrel	*Sciurus niger*
Pocket gopher	*Thomomys bottae*
White-footed mouse	*Peromyscus sp*
Dusky-footed woodrat	*Neotoma fuscipes*
Black tailed jackrabbit	*Lepus californicus*
Brush rabbit	*Syvilagus bachmani*
Black-tailed deer	*Odocoileus hemionus*

Source: City of Palo Alto Department of Community Services; Brown, 1999

Table 4-3 Partial List of Birds Expected in Foothills Park

SPECIES	HABITAT
Red-winged blackbird (*Agelaius phoeniceus*)	riparian, marsh, wet meadow
Brewer's blackbird (*Euphagus cyanocephalus*)	common around human habitation
Bullock's oriole (*Icterus bullockii*)	riparian, woodland, forest edge
Purple finch (*Carpodacus purpureus*)	mixed evergreen forest, forest edge
House finch (*Carpodacus mexicanus*)	woodland, human habitation
American goldfinch (*Carduelis tristis*)	marsh, woodland
American coot (*Fulica americana*)	pond
Orange-crowned warbler (*Vermivora celata*)	mixed evergreen forest, riparian, chaparral
Yellow warbler (*Dendroica petechia*)	riparian
Yellow-rumped warbler (*Dendroica coronata*)	riparian, oak woodland
Townsend's warbler (*Dendroica townsendi*)	riparian, forest, woodland
Wilson's warbler (*Wilsonia pusilli*)	riparian
Western tanager (*Piranga ludoviciana*)	conifer and mixed woodland
Black-headed grosbeak (*Pheucticus melanocephalus*)	riparian, oak woodland
Rufous-sided towhee (*Pipilo erythrophthalmus*)	woodland, riparian, forest edge
Brown towhee (*Pipilo fuscus*)	riparian, chaparral, human habitations
House sparrow (*Passer domesticus*)	cultivated land
Savannah sparrow (*Passerculus sandwichensis*)	grassland, meadow, marsh
Fox sparrow (*Passerella iliaca*)	woodland, riparian, forest, chaparral, scrub
Song sparrow (*Melospiza lincolnii*)	riparian, marsh
Lincoln's sparrow (*Melospiza lincolnii*)	wet meadow, riparian
White-crowned sparrow (*Zonotrichia leucophrys*)	wet meadow, coastal scrub, chaparral, human habitation
Dark-eyed junco (*Junco hyemalis*)	mixed woodland, forest edge
Blue-gray gnatcatcher (*Polioptila caerulea*)	generalist
Swainson's thrush (*Catharus ustulatus*)	riparian, marsh
Hermit thrush (*Catharus guttatus*)	forest, forest edge
American robin (*Turdus migratorius*)	generalist
Varied thrush (*Ixoreus naevius*)	forest
Cedar waxwing (*Bombycilla cedrorum*)	woodland, forest edge
European starling (*Sturnus vulgaris*)	generalist
Warbling vireo (*Vireo gilvus*)	riparian
Western wood-peewee (*Contopus sordidulus*)	riparian, forest edge, forest
Pacific-slope flycatcher (*Empidonax difficilis*)	mixed woodland, often near water
Black phoebe (*Sayornis nigricans*)	woodland, near water
Say's phoebe (*Sayornis saya*)	farmland, savannah, near water
Ash-throated flycatcher (*Myiarchus cinerascens*)	open woodland, riparian, scrub, chaparral
Tree swallow (*Tachycineta bicolor*)	open country, woodland, near water
Violet-green swallow (*Tachycineta thalassina*)	mixed woodland

Table 4-3 Partial List of Birds Expected in Foothills Park (continued)

Stellar's jay (*Cyanocitta stelleri*)	mixed woodland, pine-oak woodland
Western scrub jay (*Aphelocoma californica*)	woodland, chaparral
American crow (*Corvus brachyrhyncos*)	generalist
Common raven (*Corvus corax*)	wide variety of habitats, usually hilly
Chestnut-backed chickadee (*Peocile rufescens*)	mixed woodland, riparian, forest
Bushtit (*Psaltriparus minimus*)	woodland, chaparral, scrub
White-breasted nuthatch (*Sitta carolinensis*)	mature mixed woodland and forest
Brown creeper (*Certhia americana*)	riparian, mixed woodland, forest
Bewick's wren (*Thryomanes bewickii*)	open woodland, near human habitation
Ruby-crowned kinglet (*Regulus calendula*)	woodland, thicket, brush
Rock dove (*Columba livia*)	near human habitation
Band-tailed pigeon (*Columba fasciata*)	open forest and woodland
Mourning dove (*Zenaida macroura*)	open woodland; suburban areas
Anna's hummingbird (*Calypte anna*)	open woodland, chaparral, gardens
Belted kingfisher (*Ceryle alcyon*)	lakes, ponds, streams
Acorn woodpecker (*Melanerpes formicivorous*)	oak and mixed woodland
Nuttall's woodpecker (*Picoides nuttallii*)	oak woodland, chaparral, riparian
Downy woodpecker (*Picoides pubescens*)	mixed woodland, riparian woodland, orchards
Hairy woodpecker (*Picoides villosus*)	forest, riparian woodland, mixed woodland
Northern flicker (*Colaptes auratus*)	generalist
Northern mockingbird (*Mimus polyglottos*)	generalist
California thrasher (*Toxostoma redivivum*)	Mixed woodland, riparian, chaparral
California quail (*Callipepla californica*)	mixed woodland, chaparral, scrub, suburban
Pied-billed grebe (*Podilymbus podiceps*)	well-vegetated lakes, ponds, slow streams
Horned grebe (*Podiceps auritus*)	marshes, ponds, lakes
Eared grebe (*Podiceps nigricollis*)	marshes, ponds, lakes
Western grebe (*Aechmophorus occidentalis*)	marshes, lakes
Great blue heron (*Ardea herodias*)	marshes and grasslands
Great egret (*Ardea alba*)	marsh, swamp, drainage ditches
Snowy egret (*Egretta thula*)	marsh, lake, pond
Green heron (*Butorides virescens*)	riparian, pond, marsh
Black-crowned night heron (*Nycticorax nycticorax*)	marsh, swamp, pond, lake
Wood duck (*Aix sponsa*)	riparian, pond
Green-winged teal (*Anas crecca*)	densely vegetated freshwater habitats
Mallard (*Anas platyrhyncos*)	shallow pond, lake, marsh
Northern pintail (*Anas acuta*)	grassland, lake, marsh, pond
Cinnamon teal (*Anas cyanoptera*)	shallow vegetated pond, lake, marsh
Northern shoveler (*Anas clypeata*)	shallow freshwater, wet meadow
Gadwall (*Anas strepera*)	freshwater marsh
American wigeon (*Anas americana*)	freshwater marsh
Canvasback (*Aythya valisineria*)	open freshwater habitats
Ring-necked duck (*Aythya collaris*)	freshwater lake
Lesser scaup (*Aythya affininis*)	upland near pond, marsh

Table 4-3 Partial List of Birds Expected in Foothills Park (continued)

Common goldeneye (*Bucephala clangula*)	riparian, freshwater habitats
Bufflehead (*Bucephala albeola*)	mixed woodland near lake or pond
Hooded merganser (*Lophodytes cucullatus*)	forested habitats near water
Ruddy duck (*Oxyura jamaicensis*)	densely vegetated freshwater marsh, lake, pond
Turkey vulture (*Cathartes aura*)	open habitat
Yellow-breasted chat (*Icteria virens*)	mixed woodland, forest edge
Purple martin (*Progne subis*)	open areas near water
American kestrel (*Falco sparverius*)	riparian, grassland, savannah
Red-tailed hawk (*Buteo jamaicensis*)	woodlands, grassland
Red-shouldered hawk (*Buteo lineatus*)	riparian forests, wooded swamps, suburban
Cooper's hawk (*Accipiter cooperii*)	oak woodland, riparian
Sharp-shinned hawk (*Accipiter striatus*)	dense forest, riparian
Barn owl (*Tyto alba*)	grassland, farmland, open or partially open habitat
Great horned owl (*Bubo virginianus*)	woodland, grassland
Western screech owl (*Otus kennicottii*)	oak, riparian woodland, orchard
Osprey (*Pandion haliaetus*)	rivers, lakes, coast

Source: Tomas Reid Associates

4.4 Sensitive Species

Foothills Park is known to contain sensitive plant and animal species, including two federally listed threatened species, the steelhead trout (*Oncorhynchus mykiss irideus*), and the California red-legged frog (*Rana aurora draytoni*), in Los Trancos Creek. The California red- legged frog may also occur in the woodland and grassland habitat near Los Trancos Creek and in the tributaries to Los Trancos Creek. One rare plant, the Western leatherwood (*Dirca occidentalis*, CNPS List 1B), is known to occur along the Los Trancos and Steep Hollow trails. Victor's gooseberry (*Ribes victoris*), is an uncommon plant which occurs on the Costanoan Trail near the Los Trancos Trail. It is not currently listed as sensitive by CNPS or state or federal agencies, but is noted in the Jepson Manual (Hickman et. al., 1993) as "uncommon".

A search of the California Natural Diversity Database indicates that 19 sensitive species are known to occur within five miles of the park boundary. These are listed in *Table 4-4 - Sensitive Species Known or Potentially Occurring in Foothills Park*, with an indication of their habitat requirements and whether the habitat exists in Foothills Park, particularly along the existing trail system. The table also includes a number of other listed sensitive plant and animal species which are known from Santa Clara or San Mateo Counties and which could occur in Foothills Park based on habitat.

Table 4-4. Sensitive Species Known or Potentially Occurring in Foothills Park

Common Name	Status	Habitat	Habitat On Site
Potential sensitive species, occurring in the CNDDB within five miles of Foothills Park			
California red-legged frog *Rana aurora draytonii*	FT CSC CP	Pond, creek, riparian, grassland, freshwater and brackish wetland.	Potential breeding habitat in Boronda Lake, Los Trancos Creek and tributaries; foraging and estivation habitat in riparian zones, grassland, and oak woodland above Los Trancos Creek and tributaries. May occur on Los Trancos Trail.
California tiger salamander *Ambystoma californiense*	FSC CSC CP	Seasonal wetlands in grassland and oak-savannah.	No seasonal wetlands known to be present.
Western pond turtle *Clemmys marmorata*	FSC CSC CP	Ponds, creeks in woodland, grassland.	Potential habitat in Boronda Lake, Los Trancos Creek, and Arastradero Creek.
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	FSC CSC	Fresh and brackish marsh.	May use Boronda Lake.
Long-eared owl *Asio otus*	CSC	Riparian, live oak thickets, and tree stands near meadow edges.	May use oak woodland and riparian corridors in Foothills Park. Includes Chamise, Costanoan, Coyote, Fern Loop, Los Trancos, Panorama, Sunrise, Trappers, and Woodrat Trails.
Steelhead – Central California Coast ESU *Oncorhynchus mykiss irideus*	FT		Known to occur in Los Trancos Creek.
Bay checkerspot butterfly *Euphydryas editha bayensis*	FT	Serpentine grassland with host plant *Plantago erecta* and nectar plants *Layia platyglossa* and *Lasthenia californica*.	Serpentine soils are not present in Foothills Park. This species is not expected to occur there.
Robust monardella or Round-headed coyote mint *Monardella villosa* ssp. *globosa*	CNPS 1B	Openings in oak woodland and chaparral.	Habitat present in woodland and chaparral. Every trail has either woodland or chaparral, or both habitats.
Santa Cruz manzanita *Arctostaphylos andersonii*	CNPS 1B FSC	Open sites and edges of chaparral, coniferous and evergreen forest. Associated with madrone, oaks, other manzanitas, pine, redwood.	Low possibility in oak woodland and chaparral. Every trail has either woodland or chaparral, or both habitats.

Table 4-4. Sensitive Species Known or Potentially Occurring in Foothills Park (continued)

Common Name	Status	Habitat	Habitat On Site
Western leatherwood *Dirca occidentalis*	CNPS 1B	Cool, moist slopes in foothill woodland and riparian habitat. Associated with California buckeye, Coast live oak, California bay laurel, ferns, poison oak.	Foothill woodland, mixed evergreen forest and riparian. Occurs on site along the Los Trancos and Steep Hollow Trails. Potential habitat also along the Chamise, Costanoan, Coyote, Fern Loop, Panorama, Sunrise, Toyon, Trappers and Woodrat Trails. (See Figure 4-2)
Slender-leaved pondweed *Potamogeton filiformis*	CNPS 2	Shallow, clear fresh water of lakes and drainage channels, marshes and swamps.	Presumed extinct in Santa Clara County. Likelihood of occurrence is very low. Potential habitat in Boronda Lake.
Lost thistle *Cirsium praeteriens*	CNPS 1A	Unknown.	Presumed extinct in CA.
Legenere *Legenere limosa*	CNPS 1B	Wet areas, vernal pools.	Potential habitat along drainages, Boronda Lake.
Franciscan onion *Allium peninsulare* var. *franciscanum*	CNPS 1B	Cismontane* woodland, valley and foothill grassland.	Habitat present in oak and mixed evergreen woodland, and grasslands. Every trail has at least one of these habitats.
Fragrant fritillary *Fritillaria liliacea*	CNPS 1B	Moist areas, often ultramafic, open hills in valley and foothill grasslands.	The grassland in Foothills Park generally does not contain seeps or moist areas; this plant is not expected to occur there.
Dudley's lousewort *Pedicularis dudleyi*	CR CNPS 1B	Coniferous forest, maritime chaparral.	These habitats are not present in Foothills Park. This plant is not expected to occur in the Park.
Ben Lomond buckwheat *Eriogonum nudum* var. *decurrens*	CNPS 1B	Chaparral, cismontane woodland, lower montane coniferous forest.	Habitat present in chaparral and woodland. Every trail has at least one of these habitats.
North Central Coast steelhead/sculpin stream			Los Trancos is a known steelhead stream.
Serpentine bunchgrass			Serpentine soils are not present in Foothills Park. This community is not expected to occur there.
Additional potential sensitive species			
Foothill yellow-legged frog *Rana boylei*	FSC CSC CP	In or near rocky streams in a variety of habitats; requires permanent water and dense cover.	Potential habitat in Los Trancos Creek and tributaries. May occur on Los Trancos Trail.
San Francisco Garter Snake *Thamnophis sirtalis tetrataenia*	FE CE	Ponds, marshes.	Potential habitat in Boronda Lake.

Table 4-4. Sensitive Species Known or Potentially Occurring in Foothills Park (continued)

Common Name	Status	Habitat	Habitat On Site
White-flowered rein orchid *Piperia candida*	CNPS 4	Open to shaded coniferous forest and mixed evergreen forest. Associated with tanoak, madrone, redwood.	Possibly in foothill woodland or mixed evergreen forest; no coniferous forest in Foothills Park. Potential habitat along portions of Chamise, Coyote, Fern Loop, Los Trancos, Panorama, Toyon and Woodrat Trails.
San Francisco collinsia *Collinsia multicolor*	CNPS 4	Moist shady woodland, associated with California buckeye, honeysuckle, ferns, coast live oak, poison oak.	Habitat present in oak woodland. *Collinsia heterophylla* is known to occur in the Park in foothill woodland and mixed evergreen forest, chaparral and at the edges of these habitats. Potential habitat occurs along Chamise, Costanoan, Coyote, Fern Loop, Los Trancos, Panorama, Sunrise, Trappers, and Woodrat Trails.
Mexican mosquito fern *Azolla mexicana*	CNPS 4	Ponds, slow streams, wet ditches, marshes and swamps; associated with tule, cattail, mannagrass, hydrocotyle.	Potential habitat in Boronda Lake.
Big-scale balsamroot *Balsamorhiza macrolepis macrolepis*	CNPS 1B	Valley and foothill grassland and foothill woodland slopes; associated with yarrow, oat grass, brome grass, soap plant, rye grass, blue wildrye, tarweed, yampah, coast live oak, valley oak, poison oak, coffeeberry.	Habitat present in grassland and oak woodland. Each trail has at least one of these habitats in at least a portion.
Forget-me-not popcorn flower *Plagiobothrys myosotoides*	CNPS 4	Chaparral; associated with chamise, golden yarrow.	Habitat present in chaparral. This habitat is present along portions of Chamise, Costanoan, Coyote, Fern Loop, Los Trancos, Panorama, Steep Hollow, Sunrise, Toyon, and Trappers Trails.
Santa Clara red ribbons *Clarkia concinna automixa*	FSC CNPS 1B	Mesic shaded oak woodland; associated with oat grass, clarkia, eriogonum, white globe lily, yarrow, bedstraw, monkey flower, phacelia, sage, poison oak.	Habitat present in woodland areas. Habitat occurs along portions of Chamise, Costanoan, Coyote, Fern Loop, Los Trancos, Panorama, Sunrise, Trappers and Woodrat Trails. The more common species *Clarkia concinna* occurs in park in woodland and streamside habitats.

Table 4-4. Sensitive Species Known or Potentially Occurring in Foothills Park (continued)

Common Name	Status	Habitat	Habitat On Site
San Francisco Dusky-footed Woodrat *Neotoma Fuscipes annectens*	CSC	Chaparral, riparian, woodland; needs grasses for nest building material.	Known to occur along Woodrat Trail. Nesting habitat in riparian vegetation and oak woodland, forage in all habitats on site.
Ringtail *Bassariscus astutus*	CP	Brush, rocky areas, near water.	Forage habitat in riparian zone; possible nesting in hollow trees in riparian zone. Los Trancos Creek provides most likely habitat.
Pallid bat *Antrozous pallidus*	CSC	Arid habitat, open woods, crevices or chambers in rocky areas or buildings. Sensitive to human intrusion.	Potential, however no rocky areas or uninhabited buildings are in the Park.
Townsend's western big-eared bat *Corynorhinus townsendii townsendii*	CSC	Mesic habitat, roosts in caves, old buildings. Sensitive to human intrusion.	Forage habitat available in Park; only trees available for roosting.
Mexican free-tailed bat *Tadarida brasiliensis*	CSC	Open areas, buildings, highly colonial.	Forage habitat available in Park; buildings available for roosting are restrooms and interpretive center.
Big brown bat *Eptesicus fuscus*	CSC	Closely associated with humans, often colonizes buildings, roosts in hollow trees, hibernates in caves, prefers deciduous to coniferous forest.	Forage habitat available; roosting trees available; no deciduous or coniferous forest present.
Silver haired bat *Lasionycteris noctavigans*	CSC	Woods near ponds and streams; roosts in trees and buildings.	Forage and roosting habitat available.
California myotis *Myotis californicus*	CSC	Rocky canyons with trees and open water; desert scrub; roosts in buildings.	Rocky canyon, desert scrub habitat not at site. Boronda Lake may provide open water forage habitat.
Long-eared myotis *Myotis evotis*	CSC	Forest, woodland; roosts in buildings and caves.	Forage habitat available; no caves known.
Long-legged myotis *Myotis volans*	CSC	Coniferous forest, desert, riparian, roosts in buildings, rocks, trees; forages over open water and open woods.	Riparian, open water, open woods, trees available for forage and roosting. No desert habitat.
Yuma myotis *Myotis yumanensis*	CSC	Variable habitats and open water. Roosts in buildings.	Forage habitat available; two buildings available for roosting.

Notes: FE-Federal Endangered; FT-Federal Threatened; FSC-Federal Species of Concern; CE- California State Endangered; CR-California State Rare; CP-California Protected; CSC-California Species of Concern; CNPS 1B-plants rare, threatened or endangered in California and elsewhere; CNPS 2-plants rare, threatened, or endangered in California

but common elsewhere; CNPS 3-plants about which we need more information, a review list; CNPS 4-plants of limited distribution, a watch list.

*Cismontane woodland: Trees deciduous, evergreen, or both, with open canopies. Broadleaved trees, especially oaks, dominate, although conifers may be present in or emergent through the canopy. Understories may be open and herbaceous or closed and shrubby. (CNPS)

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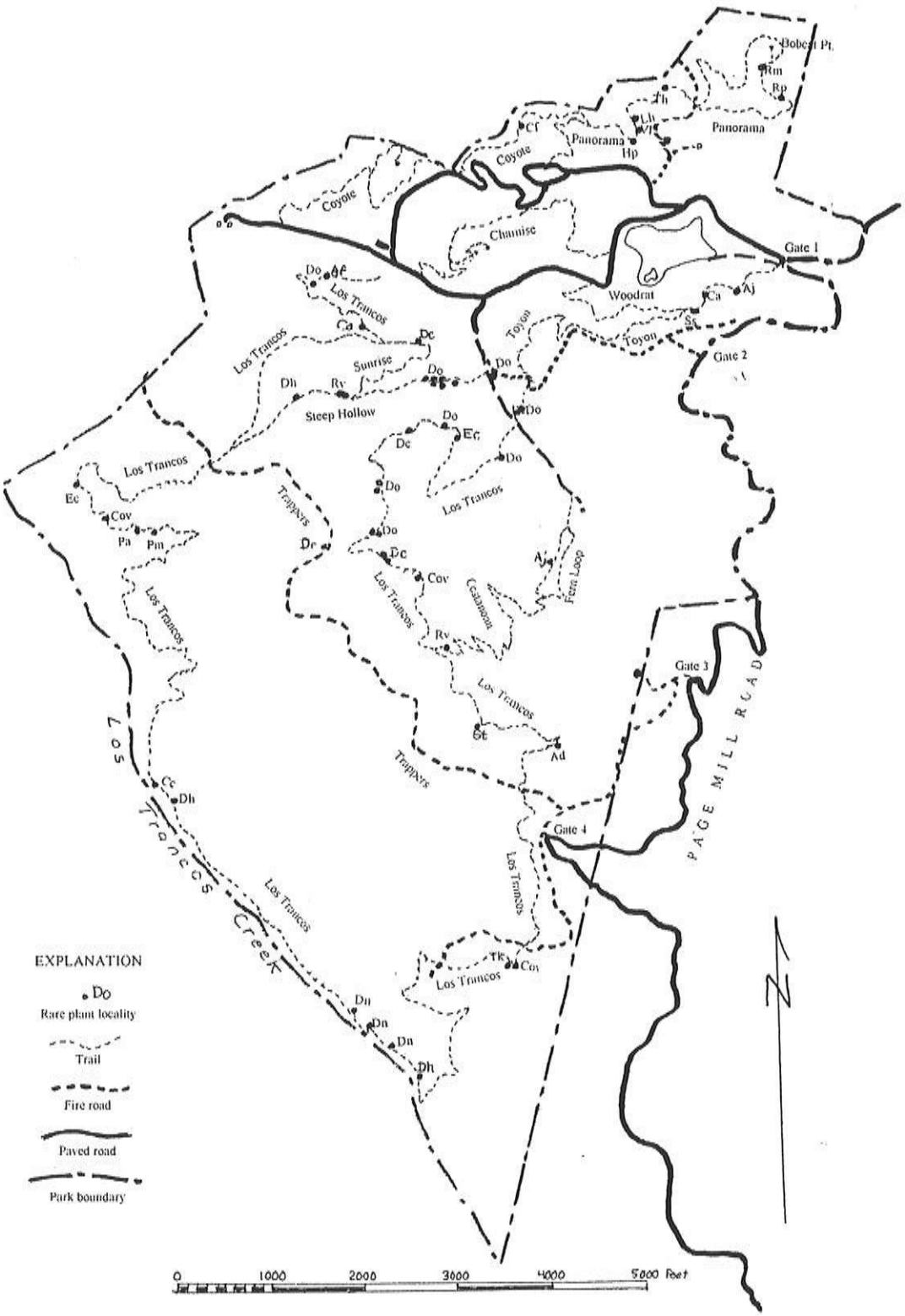
In addition to legally protected species, the Friends of Foothills Park has identified, through observation of trail maintenance activities, a list of native plants which are slow to regenerate along the trail once they are damaged or removed, or which are unusual sights within the park. These plants are thus thought to be particularly susceptible to permanent removal during trail maintenance and warrant some protection under the maintenance plan. They consist primarily of perennial herbs that constitute low-growing vegetation along the trails. These species are listed in *Table 4-5 Plants Subject to Severe Impact by Trail Work in Foothills Park* and the known locations are shown on *Map 4-2 - Known Locations of Plants of Concern* (keyed *to Table 4-5 - Plants Subject to Severe Impact by Trail Work in Foothills Park*).

Nesting Birds

Birds are protected under various laws. The California Department of Fish and Game Code protects all nesting birds from nest removal. Some bird species are also protected from nest removal and harassment during the nesting season under the Migratory Bird Treaty Act. The reason is to protect the reproductive viability of the bird population. Birds which have perennial nests (nests which are used year after year), are particularly susceptible to the loss of reproductive success if the nests are removed. Perennial nesters include several raptor species (hawks, owls, falcons, osprey, eagles). Trail maintenance should not remove perennial nests and should not remove occupied nests. Pre-maintenance surveys should be conducted to identify nest sites. If an occupied nest is identified adjacent to the trail or in a tree or shrub that must be trimmed or removed (including poison oak), trail maintenance should be deferred until the nestlings have fledged. Trail maintenance with mechanized equipment should not occur within 20 feet of the nest, and with hand equipment should not occur within 10 feet of the nest. Once a non-perennial nest has been abandoned, planned trail maintenance can occur closer to the nest.

Nesting Mammals

Protected mammals which nest or roost in trees or which build perennial ground nests, and which could be adversely affected by trail maintenance include all of the bat species listed in *Table 4-4 - Sensitive Species Known or Potentially Occurring in Foothills Park*, the dusky-footed woodrat, and the ringtail cat. Trail maintenance should avoid the removal of trees containing hollows that would provide roost or nest sites for bats or ring-tail cat, and should avoid the removal, disturbance or burial of any woodrat nest. A pre-maintenance survey should identify any such potential roost or nest sites that would be trimmed or removed as part of trail maintenance and determine if those sites exhibit sign of current use. If current use is apparent, trail maintenance with mechanized equipment should not occur within 20 feet of the nest during the breeding season (approximately April 1 to October 31, depending on the species), and trail maintenance



FOOTHILLS PARK
KNOWN LOCATIONS OF RARE PLANTS SUBJECT TO
SEVERE IMPACT BY TRAIL WORK, 2001
[See accompanying list for explanation of map symbols]

Map 4-2 KNOWN LOCATIONS OF PLANTS OF CONCERN

with hand equipment should not occur within 10 feet of the nest (so there should be a 10 to 20 foot moratorium zone around the site). Trees with hollows which are identified as bat roosts or potential nest sites for ringtail cat should always remain protected, with trail maintenance within 10 feet of the site limited to the use of hand tools.

Table 4-5 Plants Subject to Severe Impact by Trail Work in Foothills Park

Map Symbol	Scientific Name	Common Name	Plant type	Comments
Ad	*Arnica discoidea*	Rayless arnica	hp	Open slopes and edges of chaparral; Los Trancos Trail
Af	*Aquilegia formosa*	Crimson columbine	hp	Mixed evergreen forest, brush covered slopes. Usually in damp, shady places along trails. Known along Los Trancos Trail.
Aj	*Adiantum jordanii*	Maidenhair fern	fe	Moist, shaded slopes in woodland. Not uncommon, but has been severely impacted by trail work, especially on Fern Loop and Steep Hollow trails.
Ak	*Antirrhinum kelloggii*	Kellogg's or lax snapdragon	ha	Disturbed areas, especially burns. Uncommon on trails in chaparral (potentially Chamise, Costanoan, Coyote, Fern Loop, Los Trancos, Panorama, Steep Hollow, Sunrise, Toyon and Trappers Trails)
Au	*Allium unifolium*	Single-leaf onion	hp	Moist clay or serpentine, grassy streambanks. An uncommon plant range-wide. Not mapped.
Ca	*Castilleja affinis*	Indian paintbrush	hp	Open slopes, borders of chaparral and wooded areas. Known along Woodrat Trail
Cc	*Clarkia concinna*	Lovely clarkia; red ribbons	ha	Open woodland. Seen only on Los Trancos Trail near Los Trancos Creek. Santa Clara red ribbons (C. c. ssp. automixa) is a federal species of special concern and on CNPS List 1B
Cf	*Castilleja foliolosa*	Wooly indian paintbrush	hp/ss	Edges of chaparral, on dry rocky slopes. Not uncommon, may favor trailside locations
Cov	*Cirsium occidentale venustum*	Venus thistle	hp	Disturbed places in grassland and woodland. Native thistle with distinctive red flower
Dc	*Delphinium californicum*	California larkspur	hp	Grows in thickets and chaparral. Known along Los Trancos Trail
Dh	*Disporum hookeri*	Hooker's fairy bells	hp	Shaded places in mixed forest and brush. Steep Hollow; Los Trancos Trails
Dn	*Delphinium nudicaule*	Red delphinium	hp	Mixed evergreen forest. Seen along trails in dense riparian woodland; Los Trancos Trail
Do	*Dirca occidentalis*	Western leatherwood	sh	Moist wooded hillsides. Rare plant (CNPS List 1B) known on Steep Hollow, Los Trancos trails

Table 4-5 Plants Subject to Severe Impact by Trail Work in Foothills Park (continued)

Map Symbol	Scientific Name	Common Name	Plant type	Comments
Dr	*Dendromecon rigida*	Bush poppy	sh	Chaparral. Last known location was along Trapper's Trail but was removed by clearing
Ec	*Epilobium canum*	California fuchsia	hp	Rocky soil in chaparral
Fa	*Fritillaria affinis*	Checker lily	hp	Wooded slopes, oak scrub, grasslands. Uncommon in Foothills Park.
Hp	*Helenium puberulum*	Rosilla; sneezeweed	hp	Creek beds and marshy meadows along streams and lakes. Known only in one place along Panorama Trail
Lh	*Lotus humistratus*	Hill lotus	ha	Grassland, moist chaparral
Lw	*Lotus wrangelianus*	California lotus	ha	Chaparral, disturbed areas
Pa	*Pellaea andromedifolia*	Coffee fern	fe	Dry, open or shaded habitats, usually among rock outcroppings, often in chaparral. Uncommon fern in dry, sunny locations on Los Trancos Trail
Pc	*Polypodium californicum*	California polypody	fe	Found in a variety of habitats. Not uncommon, but has been severely affected by trail clearing
Pm	*Pellaea mucronata*	Bird's-foot fern	fe	Dry, rocky outcrops. Uncommon fern in dry, sunny locations on Los Trancos Trail
Pt	*Pityrogramma triangularis*	Gold-backed fern	fe	Shaded slopes in oak-madrone woodland, brushy slopes, moist banks. Not uncommon, but has been adversely affected by trail clearing
Rm	*Ribes malvaceum*	Chaparral currant	sh	Shaded ravines and chaparral slopes. Not uncommon, but was excessively cleared near Bobcat Point
Rph	*Rupertia physodes*	California tea	hp	Oak-madrone woods, shaded chaparral. Known only from one location along Panorama Trail
Rv	*Ribes victoris*	Victor's gooseberry	sh	Uncommon species of canyon forests and chaparral range-wide; Foothills Park may be south of known range. Known to occur along Costanoan Trail. One shrub was removed during trail clearing in 1998
Sd	*Satureja douglasii*	Yerba buena	hp	Not uncommon, but favors trail edge. Recovers only slowly
Sm	*Smilacina racemosa*	Fat false Solomon's seal	hp	Shade and rich soil in mixed evergreen forest. Formerly more extensive along trails; present locations unknown
Ss	*Smilacina stellata*	Slim false Solomon's seal	hp	Wooded slopes in partial shade. Formerly more extensive along trails

Table 4-5 Plants Subject to Severe Impact by Trail Work in Foothills Park (continued)

Map Symbol	Scientific Name	Common Name	Plant type	Comments
St	*Scutellaria tuberosa*	Dannie's skullcap	hp	Oak-madrone woods, borders of shrubby vegetation. Not uncommon, but favors trail edge. Recovers only slowly
Th	*Tauschia hartwegii*	Hartweg's tauschia	hp	Occasional on wooded slopes. Recovers slowly
Tk	*Tauschia kelloggii*	Kellogg's tauschia	hp	Grassland, edges of chaparral and edges of chaparral. Recovers slowly
Tl	*Trientalis latifolia*	Pacific starflower	hp	Shaded slopes, moist woods, occasionally in the open. Trailside locations in areas of dense shade. Not mapped
Vl	*Verbena lasiostachys*	Western verbena	ha	Dry ground of disturbed areas, creek bottoms, roadsides, edges of brushy vegetation. Less abundant after 1998 trail work

Sources: Friends of Foothills Park (Olmsted 1999); Thomas 1961

4.5 Noxious Plants & Pathogens

Noxious Plants

Noxious plants include plants which can cause direct damage to humans (e.g. poison oak) and non-native plants which cause damage to the native ecosystem by displacing several native species with one invasive species, thus reducing diversity. The non-native invasive plant species of greatest concern that are known to occur or which could likely occur in Foothills Park are described in *Table 4-6 Non-native Invasive Plants of Greatest Ecological Concern in Foothills Park.* These plants have been identified by the California Exotic Pest Council (CalEPPC) as the invasive species of greatest concern for causing ecological damage in California. Information about CalEPPC, and the plant list is included in *Appendix A – Exotic Pest Plants of Greatest Ecological Concern in California.*

Control and prevention of non-native invasive plant species is quite important. As noted in Bossard et. al. (2000), "Invasive [non-native] species are now widely recognized worldwide as posing threats to biological diversity second only to direct habitat loss and fragmentation." Infestations of non-native invasive plant species have been found to alter ecosystem functions such as nutrient cycles, hydrology, and wildfire frequency. They have been found to outcompete and exclude native plants and animals and hybridize with native species. Non-native invasives can alter community structure, degrade or eliminate habitat for native animals, and in some situations have been found to alter natural succession by preventing re-establishment of native species following natural or human-caused disturbance. For instance, ryegrass (*Lolium multiflorum*), often used as an erosion control grass, has been observed to retard chaparral recovery (Bossard et. al., 2000). The spread of these plant species into parks and preserves can reduce or eliminate the habitats these areas were set aside to protect.

Non-native invasive plant species pose a complex management problem, but management is key to preventing long-lasting and insidious effects on the native ecosystem. Particular vigilance is necessary to prevent and control infestations. Trail maintenance activities need to address the fact that most of these species gain a foothold by invading soil that has been disturbed, such as through re-grading or vegetation clearing that results in the removal of ground cover plants adjacent to the trail tread.

Poison oak (*Toxicodendron diversilobum*) is not included in the list in *Table 4-6 - Non-native Invasive Plants of Greatest Ecological Concern in Foothills Park.* Poison oak is a native plant which contains oils that commonly cause a severe skin rash in humans. Otherwise it is native to the ecosystem in the park, providing food and shelter for animals and insects which naturally occur there. As a result of the allergic reaction it causes, poison oak is a considered a noxious plant only where it occurs along trail alignments where park visitors could come into direct contact with it. It is generally controlled by cutting it back along the trails so that it does not protrude into the path of hikers.

Table 4-6 Non-native Invasive Plants of Greatest Ecological Concern in Foothills Park

Common Name (Scientific Name)	Description	Habitat	Presence in Foothills Park	Problems Caused by Plants	Control Techniques & Concerns
Giant reed *(Arundo donax)* Poaceae	robust perennial grass to 30 feet tall. Spreads vegetatively by rhizomes or fragments	moist areas along lakes and streams	not known; habitat is present	monopolizes soil moisture, shades out natives; creates massive stands; reduces habitat and food supply for wildlife, particularly birds	under study; hand pulling if under 6 ft tall; roots must be removed. Mechanical very difficult; burning not recommended; no biological controls approved by USDA yet; grazing has limited value
Garden bellardia (*Bellardia trixago*) Scrophulariaceae	glandular, hairy annual with snapdragon-like flowers, 6 to 20 inches tall. Spreads by seed.	disturbed areas and coastal grasslands ; can grow on serpentine	yes in disturbed areas	displacement; parasitizes native plants for water and food	No information
Foxtail chess (*Bromus madritensis* ssp. *rubens*) Poaceae	annual grass with a brush-like inflorescence . Becomes purplish at maturity. Spreads by seed.	weedy grass of grassland and scrub habitats	not known	altered patterns of wildfire, microhabitat characteristics, nutrient cycling; competition for soil nutrients and light	hand pulling; burning not recommended unless done in early spring before seeds are fully mature; black smut fungus and grazing

Table 4-6 Non-native Invasive Plants of Greatest Ecological Concern in Foothills Park (continued)

Common Name (Scientific Name)	Description	Habitat	Presence in Foothills Park	Problems Caused by Plants	Control Techniques & Concerns
Foxtail chess (*Bromus madritensis* ssp. *rubens*) Poaceae (continued)					have limited value; chemicals not practical or registered for wildland use
Italian thistle (*Carduus pycnocephalus*) Asteraceae	annual thistle six inches to 6 feet tall. Thimble-sized rose to pink to purple flowers. Spreads by seed.	chaparral, oak savanna, meadows, disturbed areas	yes, disturbed areas, including along trails and fire breaks in various habitats	crowds out natives; can carry grass fires to tree canopies	hand pulling must remove plant at least four inches below ground; mowing not reliable as seed can be reproduced even if thistles are consistently mowed at three inches; cultivation may work if repeated for as long as ten years; no USDA approved biological controls; sheep or goat grazing promising; herbicides effective.
Purple starthistle (*Centaurea calcitrapa*) Asteraceae	annual to perennial thistle with mounding growth and purple flowers. Spreads by seed.	Disturbed areas	yes, disturbed areas, including along trails and fire breaks in various habitats	pasture pest, preventing forage by natural and introduced grazers	Hand grubbing must remove plants at least two inches below the surface early in the growing season; mowing not effective; no biological control; grazing may help if managed correctly; herbicides effective
Tocolote (*Centaurea melitensis*) Asteraceae	winter annual thistle with mounding growth 2 to 36 inches tall with yellow flowers. Very similar to yellow	grassland, disturbed areas	yes	crowds out natives; reduces seed production in endangered Acanthomintha ilicifolia; causes disease in horses	biology not well studied; little work done on control methods, but likely the same as yellow starthistle except for biological control. One type of beetle is

Table 4-6 Non-native Invasive Plants of Greatest Ecological Concern in Foothills Park (continued)

Common Name (Scientific Name)	Description	Habitat	Presence in Foothills Park	Problems Caused by Plants	Control Techniques & Concerns
Tocolote (*Centaurea melitensis*) Asteraceae (continued)	starthistle. Spreads by seed				implicated as a biological control (Lasioderma haemorrhoidale)
Yellow starthistle (*Centaurea solstitialis*) Asteraceae	winter annual or short-lived perennial with many solitary, spiny yellow flowers. Size ranges from ankle to shoulder height. Spreads by seed.	Grassland, disturbed sites, rangeland, roadsides, pastures	yes	crowds out natives; depletes soil moisture; causes disease in horses	repeated tillage prior to seed production; repeated mowing when 2 to 5 percent of the seed heads are flowering and lowest branches are above the height of the mower blades; burning in June/July for numerous seasons.
Canada thistle (*Cirsium arvense*) Asteraceae	perennial; 1 to 4 feet tall; alternate leaves, purple or white flowers. Propagates through root system; seedling survival is poor.	cultivated fields, roadsides, pastures	not known	Noxious weed; competes with natives for water; produces allelopathic chemicals that prevent other seeds from germinating; accumulates nitrates that poison animals	Has 20 closely related California native species. No easy method of control, and all methods require follow up. Combination of mechanical, cultural and chemical methods recommended.
Bull thistle (*Cirsium vulgare*) Asteraceae	biennial thistle 2 to 6 feet tall; purple flowers	coastal grasslands, edges of fresh and brackish marshes, meadows, moist forest openings	yes, disturbed areas, including along trails and firebreaks in various habitats	Displaces native species; interferes with livestock grazing; impacts reforestation	20 closely related native species.
Poison hemlock (*Conium maculatum*) Apiaceae	Biennial. Hollow stems with purple spots. Two to ten feet tall. Small white flowers in an umbrella-like cluster.	Roadsides, fields, meadows, pastures, riparian forests and flood plains. Moist, shaded disturbed areas	yes, in grassland and disturbed areas	Spreads quickly and outcompetes natives. High toxicity to vertebrates.	Use of gloves and mask recommended when handling poison hemlock. Hand pulling is effective; repeated spring and summer mowing effective (at least 3 years).

Table 4-6 Non-native Invasive Plants of Greatest Ecological Concern in Foothills Park (continued)

Common Name (Scientific Name)	Description	Habitat	Presence in Foothills Park	Problems Caused by Plants	Control Techniques & Concerns
Poison hemlock (*Conium maculatum*) Apiaceae (continued)					Biological control is under study. Chemical control is effective.
Pampas grass (*Cortaderia selloana*) Poaceae	perennial grass 6 to 13 ft tall, with a tall, plumed off-white flower. Spreads by fragmentation or seed.	Sandy, moist soil	Not known. Habitat occurs in the park, and this plant is frequently introduced via seed from garden plantings	Competes with natives; creates fire hazard.	Manual removal and chemical means effective
Cotoneaster (*Cotoneaster buxifolius*) Rosaceae	evergreen shrubs to ten feet tall; white flowers and red berries	forests, shrublands and grasslands	yes, oak woodland and disturbed	Displace native, particularly Toyon.	Closely related to native Toyon (*Heteromeles arbutifolia*). Weedwhack just after fruit set but before ripening for 2 to 3 years; chemical control
Hawthorn (*Crataegus monogyna*) Rosaceae	deciduous shrub to small tree with clusters of small white flowers in spring and red berries in fall. Reproduces by seed.	riparian, abandoned fields and pastures, oak woodlands, forested habitats	yes, Crataegus sp. identified in the park	Displaces native plants, blocks wildlife dispersal.	Weeded in early summer. Chemical control.
Artichoke thistle (*Cynara cardunculus*) Asteracea	perennial herb, leafy, branched, stout to 5 feet. Striking flowers with purple, sometimes blue corollas. Spreads by seed.	Grassland, disturbed places	Not known. Habitat present	reduces forage production and limits movement of livestock. Competes with natives for light, water and nutrients.	Repeated grubbing and herbicide application (5 years)

Table 4-6 Non-native Invasive Plants of Greatest Ecological Concern in Foothills Park (continued)

Common Name (Scientific Name)	Description	Habitat	Presence in Foothills Park	Problems Caused by Plants	Control Techniques & Concerns
Scotch broom (*Cytisus scoparius*) Fabaceae	perennial shrub six to ten feet tall; pea-like flowers.	Disturbed areas	yes	displaces native plant and forage species & makes reforestation difficult.	Removal with weed wrenches for five to ten years; cutting or brush-hogging; prescribed burning; some biological controls; chemical control all possible. Cut in fall and burn in spring found most effective. Takes many years of monitoring.
Cape or German ivy (*Delairea odorata*) Asteraceae	perennial vine with shiny five to six pointed leaves. Spreads vegetatively.	Shady, disturbed sites with year-round moisture	Not known. Habitat is present	overcomes and smothers vegetation, becoming a monoculture	manual removal followed by revegetation; biological controls are under study; chemical control in late spring
Veldt grass (*Ehrharta* spp) Poaceae	tussock-forming perennial grass. Spreads by seed.	Variety of habitats in the San Francisco Bay Area	Not known. Currently thought to be expanding its range in California in many habitat types. Habitat is present.	Invasion into shrub communities causes rapid shift into grassland, altering local ecology and changing fire cycles	manual removal has limited success; fire is not recommended; grazing not effective; chemical control has been effective.
Blue gum (*Eucalyptus globulus*) Myrtaceae	tall (150 to 180 ft), long-lived, straight growing tree; smooth bark; waxy green, sickle-shaped leaves, waxy acorns. Spreads by seed.	deep alluvial soils; grassland	Not known. Can invade from nearby areas.	Displaces native vegetation and habitat; allelopathic; high fire danger	combination of removal and chemical controls

Table 4-6 Non-native Invasive Plants of Greatest Ecological Concern in Foothills Park (continued)

Common Name (Scientific Name)	Description	Habitat	Presence in Foothills Park	Problems Caused by Plants	Control Techniques & Concerns
Fennel (*Foeniculum vulgare*) Apiaceae	erect perennial herb, four to ten feet tall. Feathery leaves and strong anise scent. Yellow flowers in umbrella-shaped clusters. Spreads by root crown and seed.	Open, moist, disturbed areas	yes in grassland and disturbed areas	Excludes native species; alters stucture of existing plant community. May be allelopathic.	Manual removal including roots; fall burns followed by herbicide application for two springs found effective; no biological control.
French broom (*Genista monspessulanus*) Fabaceae	Upright evergreen shrub to ten feet tall; small yellow pea-like flowers. Spreads by seed.	coastal plains, mountain slopes, disturbed places. Can withstand low fertility soils.	yes, in disturbed areas, including along trails in all habitat types	displaces native and forage species and hampers reforestation	similar to Scotch broom
English ivy (*Hedera helix*) Araliaceae	evergreen woody vine; spreads vegetatively and by seed	forests	Not known. Possible garden escape. Habitat present.	Can alter natural succession patterns in forests; blocks regeneration; reduces diversity	manual removal; combination of manual removal and herbicide application
Harding grass (*Phalaris aquatica*) Poaceae	Erect, perennial waist-high grass with dense spike-like flowering heads. Spreads by seed.	Grassland	Yes, in disturbed areas, grassland	displaces native species; fire hazard	mowing when plants are still green but soil moisture is low; burning after mid-January; mowing, irrigation and application of herbicide; heavy grazing or grazing with geese; chemical control. Revegetation with other species necessary for control.

Table 4-6 Non-native Invasive Plants of Greatest Ecological Concern in Foothills Park (continued)

Common Name (Scientific Name)	Description	Habitat	Presence in Foothills Park	Problems Caused by Plants	Control Techniques & Concerns
Castor bean (*Ricinus communis*) Euphorbiaceae	perennial shrub 3 to 15 feet tall; large palmate leaves dark green/red. Spiny fruit capsule. Spreads by seed.	Riparian; drainage ditches	Not known.	Displaces native vegetation. Seeds are highly toxic.	Manual removal most recommended. Chemical control also possible.
Spanish broom (*Spartium junceum*) Fabaceae	tall perennial shrub that is leafless part of the year. Yellow pea-like flowers. Spreads by seed.	Disturbed places, chaparral	Yes	rapidly colonizes disturbed places, preventing regrowth of native habitat	hand removal in stands of one to four years of age; likely highly susceptible to chemical methods; more information is needed.
Medusahead (*Taeniatherum caput-medusae*) Poaceae	slender annual grass. Spreads by seed	grasslands , oak savanna, oak woodland, chaparral	Not known. Habitat present	outcompetes native grasses and forbs	mowing or mowing and grazing found effective; burning prior to seed dispersal; chemical methods possible
Periwinkle (*Vinca major*) Apocynaceae	spreading perennial vine with smooth leaves and purple flowers. Spreads vegetatively	damp, shaded soils	Yes, adjacent to parking lot; potentially along creek adjacent to irrigated meadow	once established becomes a monoculture, reducing diversity and disrupting native ecology	hand removal effective. Mowing or cutting not effective as it promotes growth. Chemical control after cutting has been effective.

Sources: Bossard, Carla C., John M. Randall and Marc C. Hoshovsky. 2000. Invasive Plants of California's Wildlands. Univeristy of California Press.; also, Franklin Olmsted

Pathogens

Sudden Oak Death is caused by the pathogen *Phytophthora ramorum*. This pathogen kills oaks and several other California woodland species found in Foothills Park. The pathogen appears to kill trees and shrubs swiftly and could greatly impact visual integrity and diversity of the California Oak woodland as it is defined today. First discovered in California on Tan Oaks in 1995, it has now been confirmed in ten California counties, including Santa Clara County. Information on this disease is still minimal as researchers seek to develop a baseline regarding the cause, it distribution and potential controls. However, given that several plant species are being impacted in Santa Clara County and that Foothills Park contains prime habitat that is susceptible to this disease, staff should keep up with the research on this pathogen. *Appendix B – Sudden*

Oak Death provides a summary on current recommendations for managing and preventing the disease

4.6 Cultural Resources

The Santa Cruz Mountains have historically provided food and occasionally shelter for indigenous peoples inhabiting the bay area. The mountains also have a history of logging after Europeans settled the area.

Foothills Park has a primarily hilly terrain and may have provided hunting and fishing grounds for local Native American tribes, which may have had temporary encampments there. Middens and other evidence of Native American encampment are more common at lower elevations along the creeks or closer to the bay. Evidence of Native American use has been found along Matadero Creek and Deer Creek. To date, no evidence of Native American settlement has been found in Foothills Park (G. Betts, personal communication). Similarly, logging may have occurred in the park in the last 200 years, but there is no evidence of extensive logging or of former mills or artifacts associated with them.

4.7 Geology and Soils

Geology

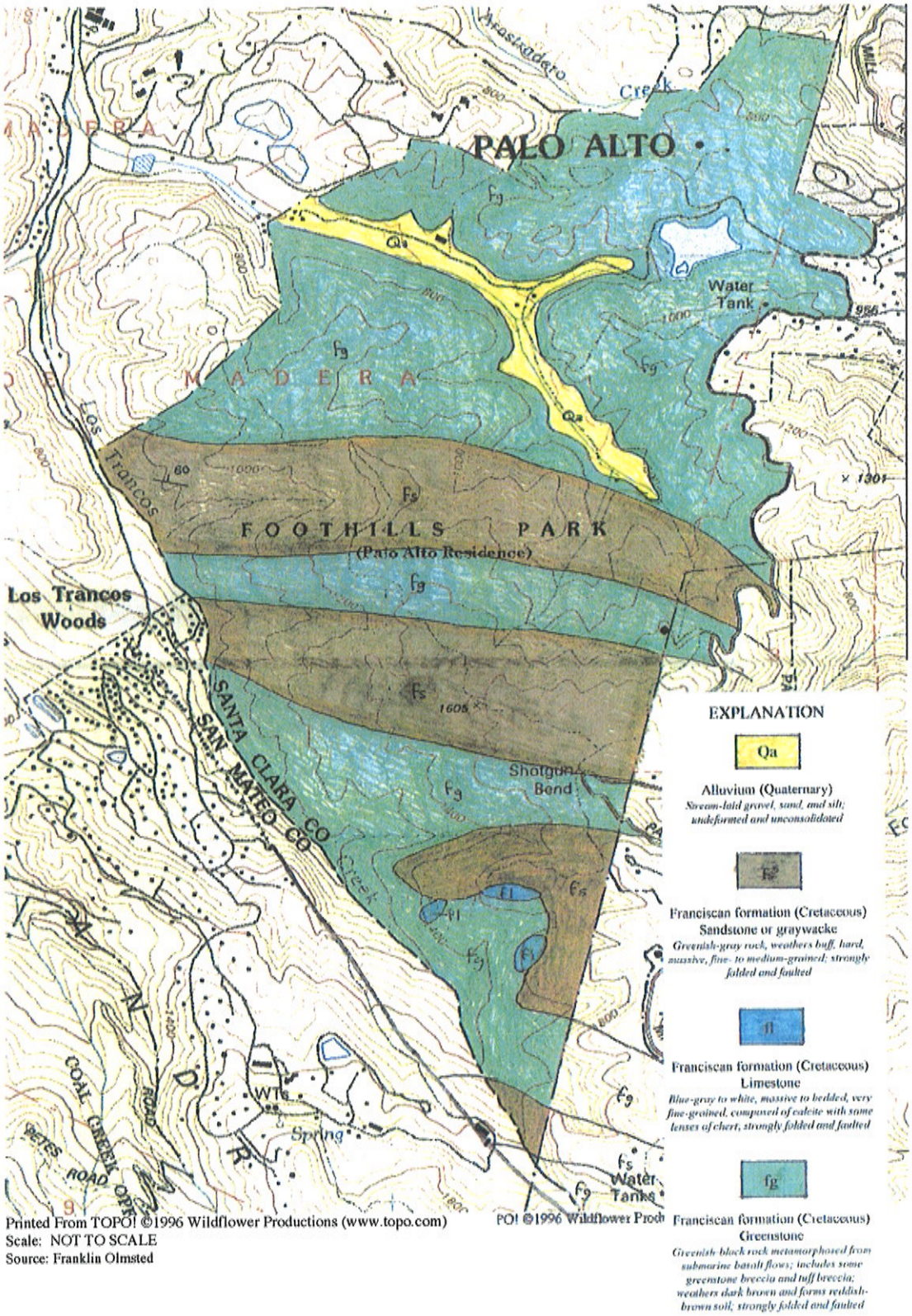
According to the geologic map of the region (Diblee, 1966), most of Foothills Park is underlain by Franciscan formation (greenstone) and Franciscan formation (sandstone or graywacke) that was formed in the Cretaceous period (See *Map 4-3 - Geology of Foothills Park*). There is also an area of alluvium (Quaternary), and three small outcroppings of Franciscan formation (limestone).

Soils

Based on information from the US Soil Conservation Service (1968) (now called the NRCS), Foothills Park contains three soil mapping units, as summarized in *Table 4-7 - Summary of Soil Conditions for Foothills Park*. Most of the park is mapped as Los Gatos-Maymen complex on 50 to 75 percent slopes, severely eroded (LkG3). The park also includes the mapping units Los Gatos Clay Loam on 15 to 30 percent slopes (LgE) and Cropley Clay on 2 to 9 percent slopes (CrC).

The Los Gatos-Maymen complex (LkG3) is an undifferentiated unit consisting of Maymen and Los Gatos soils that are intermixed. It underlies the areas in the park vegetated by woodland and chaparral, which is most of the park. Nearly all of the trail system is on this soil unit. About 60 percent of the unit consists of Los Gatos soils, described as follows:

> Los Gatos gravelly loam 50 to 75 percent slopes: "This well-drained soil is moderately fertile and holds about 4 to 7 inches of water plants can use. Subsoil permeability is moderately slow and surface runoff is very rapid. Erosion hazard is very high. Rooting depth is moderately deep to deep.... This soil is used mostly for wildlife, recreation and watershed."



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Scale: NOT TO SCALE
Source: Franklin Olmsted

Map 4-2 GEOLOGIC MAP OF FOOTHILLS PARK

About 25 percent of the soils in the Los Gatos-Maymen complex consist of Maymen soils described as follows:

> Maymen rocky fine sandy loam 50 to 75 percent slopes: "This moderately well drained soil has low fertility, because of an unfavorable calcium-magnesium ratio. It holds about 10 to 11 inches of water plants can use. Permeability is slow and surface runoff is slow. Erosion is none to slight. Rooting depth is very deep but somewhat retarded by the clay texture."

The remaining 15 percent of this mapping unit consists of Permanente soils described as follows:

> The Los Gatos Clay Loam (15 to 30 percent slopes; LgE) mapping unit "occupies moderately steep uplands mainly on the crests of well rounded ridges and on foot slopes. Texture of the surface soil is clay loam. Surface runoff is medium and erosion hazard is moderate. Otherwise, this soil is similar to Los Gatos gravelly loam, 50 to 75 percent slopes...Erosion is a problem to control when this soil is cultivated." Where this unit is mapped in Foothills Park it supports grassland. A portion of the Los Trancos Trail occurs on this mapping unit.
>
> The Cropley Clay (2 to 9 percent slopes; CrC) mapping unit occupies gently to moderately sloping alluvial fans. Surface runoff is slow to medium and erosion hazard is slight to moderate. This unit is mapped the length of Las Trampas Valley.

Table 4 - 7. Summary of Soil Conditions for Foothills Park

Soil Mapping Unit	Soil Name	Main Limitation[1]	Secondary Problem [2]	Erosion Hazard Rating	Limitations for Paths and Trails [3]
LkG3 -Los Gatos-Maymen Complex 50 to 75 percent slopes	Los Gatos Gravelly Loam	Risk of erosion	Steepness or erosion hazard	Very High	Severe
	Maymen Rocky Fine Sandy Loam	Shallow, rocky, or stony soil	Steepness or erosion hazard	Very High	Severe
LgE - Los Gatos Clay Loam 15 to 30 percent slopes	Los Gatos Clay Loam	Risk of erosion	Steepness or erosion hazard	Moderate	Moderate
CrC -Cropley Clay 2 to 9 percent slopes	Cropley Clay	Risk of erosion	Fine textured surface layer	Slight	Slight

[1] from Capability Subclass [2] from Capability Unit

[3] According to standard soil survey criteria: "Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They have moderate slopes and have few or no stones or boulders on the surface."

Slope Failures

The Santa Cruz Mountains are a geologically youthful and actively- growing mountain range as evidenced by the frequency of earthquakes and slope failures that occur. Geologic activity is also common in Foothills Park where landslides have disrupted the trail system in several areas and have the potential to continue to do so. For this reason, trail maintenance activities will need to be developed in concert with an understanding of landslide processes and their causes.

Geologists have divided landslides into three major categories. These are: (1) falls, such as rockfalls; (2) deep-seated slides, such as planar block slides and rotational slumps; and (3) flows, which include earthflows and debris flows. Debris flows, commonly referred to as "mudslides", are the most frequent type of landslide in Foothills Park and throughout the Santa Cruz Mountains. Field investigation of the park's trail system revealed trail damage caused by both debris flows and deep-seated landslides.

Deep-seated landslides typically consist of the relatively slow downhill movement of a coherent block of bedrock or soil material along a well-defined, curved or planar slip surface. These slides are also influenced by water accumulation, but are not directly triggered by high intensity rainfall. They can occur at any time of the year, but are most common in winter or spring. Some factors that make a slope more susceptible to deep-seated landslides are: steep slopes, unstable rock formations, soils with a high clay content, water accumulation, slopes undermined by streams, and slopes weakened by cuts associated with road or trail construction. A deep-seated landslide has been identified along the Los Trancos trail adjacent to Los Trancos Creek. The "Los Trancos Creek Landslide" is a deep-seated landslide that extends into Los Trancos Creek. It is a very active area that will continue to be unstable year round because it is an extremely steep slope (steepness > 100%) that is being undermined each year by stream flow. In September 2001 tension cracks were visible on the slide scar below the trail and dry ravel was actively transporting sediment into the streambed. Since the slide face exceeds the normal angle of repose, additional slope movement could occur at any time.

Debris flows, in contrast, are directly triggered by a period of high intensity rainfall falling on saturated ground. They are composed of a "slurry" of hillside soil and surficial debris that moves downhill rapidly as a flowing mass. The risk to life and limb is much higher with debris flows than with deep-seated landslides because they move faster (up to 30 mph), and can travel long distances from the site of initiation to damage structures that are downhill. For example, the run-out track of a debris flow will typically follow drainages and can damage bridge crossings a long distance away.

Evidence of historic debris flows is relatively common in the more remote parts of Foothills Park and many trails have the potential to be damaged by future debris flow events. Specific examples are known on Los Trancos Trail 0.5 mile from the junction with Trappers Trail and at Los Trancos Trail Bridge #3 and Fern Loop Bridge #2. Characteristics that make a slope susceptible to debris flow initiation are provided in *Table 4 – 8 - Slope Factors That Influence Debris Flow Susceptibility.*

Table 4-8. Slope Factors That Influence Debris Flow Susceptibility

Factor	Relative Debris Flow Risk		
	Low	Moderate	High
Slope gradient	< 50 percent	50 to 67 percent	> 67 percent
Soil depth	> 10 feet	5 to 10 feet	< 5 feet
Subsurface conditions	No shallow bedrock or impervious layers	Shallow bedrock or impervious layer present, no signs of saturated flow at boundary	Shallow bedrock or impervious layer present with signs of saturated flow at boundary
Surface conditions	No spoon-shaped depressions [1] present in hillside	Poorly-defined spoon-shaped depressions [1] are present	Well-defined spoon-shaped depressions [1] are present
Soil texture	Clay, sandy clay, silty clay loam, and clay loam	Sandy clay loam	Sandy loam, loam, and silt loam

[1] Discontinuous drainage depressions sometimes referred to as colluvial hollows.

Debris flows can be initiated on any susceptible slope once the soil is sufficiently wet and rainfall intensity exceeds a threshold value. Slope susceptibility can be reduced by diverting runoff water collected on roads or trails away from unstable slopes, constructing hillside diversion ditches and storm drain pipes to convey runoff water downhill, installing subsurface drain pipes, and establishing deep-rooted woody vegetation if it is not already present. Wherever possible, the alignment of new trails should avoid crossing slopes with a high susceptibility to debris flow activity.

4.8 Potential Environmental Impacts and Measures to Prevent or Reduce Impacts

Trail maintenance activities can potentially cause significant environmental impacts on sensitive plant and animal species, nesting wildlife, soils (through erosion), and cultural resources. Several measures are recommended in *Table 4-9 - Potential Environmental Impacts and Measures to Prevent or Reduce Them* to avoid significant effects.

Table 4-9 Potential Environmental Impacts and Measures to Prevent or Reduce Them

Impact	Measures to Prevent or Reduce Impact	Effect/ Effectiveness	Implementation
Removal of sensitive species	1. Conduct pre-maintenance surveys in the appropriate season to identify the location of sensitive plant and animal species. Avoid the removal of plants that are legally protected, listed as rare by the California Native Plant Society, or unusual sights in Foothills Park using methods such as marking or fencing and education of trail crew.	1. Will identify sensitive resource locations.	1. By rangers or others with expertise in the identification of the resources.

Table 4-9 Potential Environmental Impacts and Measures to Prevent or Reduce Them (continued)

Impact	Measures to Prevent or Reduce Impact	Effect/ Effectiveness	Implementation
Removal of sensitive species (continued)	2. Limit the removal of plants listed as slow to recover from trail clearing to the area of the trail tread. Remove only when necessary for safe passage. Leave these species as ground cover adjacent to the trail tread. 3. Trimming of sensitive shrub species (e.g.,Western leatherwood, Victor's gooseberry) shall be done under the guidance of a qualified botanist or other expert with knowledge of the species' response to trimming, and only when necessary for safe passage.	2. Will reduce the amount of native plant material removed from trail edges. 3. Will assure that trimming of sensitive shrub species is done at the correct time of year and in a way that does not compromise the health of the shrub.	2. By rangers and crew leaders. 3. By rangers and a qualified botanist or other expert with knowledge of the species' response to trimming.
Disturbance of nesting wildlife (birds, bats)	1. Trail maintenance should not remove perennial nests and should not remove occupied nests. Pre-maintenance surveys should be conducted to identify nest sites. If an occupied nest is identified adjacent to the trail or in a tree or shrub that must be trimmed or removed (including poison oak), trail maintenance should be deferred until the nestlings have fledged. Trail maintenance with mechanized equipment should not occur within 20 feet of the nest, and with hand equipment should not occur within 10 feet of the nest. Once a non-perennial nest has been abandoned, planned trail maintenance can occur closer to the nest or even result in its removal. Perennial nests should never be removed, and the area within 20 feet of the nest should be maintained with hand tools only. 2. Trail maintenance should avoid the removal of trees containing hollows that would provide roost or nest sites for bats or ring-tail cat, and should avoid the removal, disturbance or burial of any woodrat nest. A pre-maintenance survey should identify any such potential roost or nest sites	1. and 2. Will identify nest or roost sites and avoid maintenance activities which could cause nest damage, removal or abandonment. The perennial raptor nest and woodrat nest locations should be mapped for future reference.	Rangers or others with expertise in recognizing nests, hollow trees which could support bat species or ring-tail cat, perennial raptor nests, and woodrat nests

Table 4-9 Potential Environmental Impacts and Measures to Prevent or Reduce Them (continued)

Impact	Measures to Prevent or Reduce Impact	Effect/ Effectiveness	Implementation
	that would be trimmed or removed as part of trail maintenance and determine if those sites exhibit sign of current use. If current use is apparent, trail maintenance with mechanized equipment should not occur within 20 feet of the nest during the breeding season (approximately April 1 to October 31, depending on the species), and trail maintenance with hand equipment should not occur within 10 feet of the nest (so there should be a 10 to 20 foot moratorium zone around the site). Trees with hollows which are identified as bat roosts or potential nest sites for ringtail cat, as well as woodrat nests, should always remain protected, with trail maintenance within 10 feet of the site limited to the use of hand tools.		
Degradation of water quality and effects on downstream resources from erosion, herbicides and other chemicals	1. Every effort should be made in trail maintenance activities to avoid erosion (see maintenance techniques under Sub-sections 6.6 –6-9 including special management measures described in Sub-sections 6.7 and 6.9 in this handbook), since the park soils are highly erosive, and erosion leads to degradation of water quality by adding sediment to creeks downslope of the trail. This is particularly important along the Los Trancos Trail where it crosses drainages to Los Trancos Creek and where it parallels the creek, a known steelhead stream. 2. Herbicides generally should not be used in the park because most of the park is in the watershed of Los Trancos Creek, unless detailed study indicates that the level of use or type of herbicide will not impact water quality in the	1. Will reduce the amount of sediment which could be washed downslope and into creeks, adversely affecting water quality and salmonid habitat. 2. Will prevent water quality impacts from herbicide use in the park.	1. Rangers, in design of trail maintenance methods for each particular situation. 2. Under the direction of the Open Space and Science Superintendent.

Table 4-9 Potential Environmental Impacts and Measures to Prevent or Reduce Them (continued)

Impact	Measures to Prevent or Reduce Impact	Effect/ Effectiveness	Implementation
	creek. Where it is determined that spot applications of herbicides should be used in exceptional circumstances, for site specific purposes only, where other methods are deemed ineffective for achieving a desired condition, these chemicals must be applied in accordance with California State law and must adhere to the conditions set forth in the City's "Integrated Pest Management Plan" to ensure the safety of staff, visitors and wildlife and to reduce or eliminate chemicals from entering the creeks (also refer to discussion on herbicides in Sub-section 6-4). No herbicides should be used unless authorized by the wildlife agencies where trails directly parallel Los Trancos Creek (also refer to Vegetation Management in the Los Trancos Creek Corridor Sub-section 6-9). 3. Gas and oil for mechanized equipment should be contained in such a way as to prevent spills. Equipment with gas should be handled in such a way as to prevent spills. Crew training may be necessary. Spills should be soaked up with an absorbent material that is removed to a disposal site. Such absorbent material (e.g., kitty litter) should be included in the equipment list. Most spills are likely to be minor, and no significant impact is expected.	3. Will prevent water quality impacts from gas or oil spills in the park	3. Rangers shall instruct crew leaders and insure that absorbent material is in the equipment list.
Removal of or damage to cultural resources	1. Where trail work is in flatter areas or near creeks, work crews shall be taught what artifacts may look like, and to bring any such materials to the attention of the crew leader. 2. If artifacts are found, work shall stop until an archaeologist or cultural resources expert can inspect the artifact and the site.	Will help in locating cultural resources at the park and prevent extensive damage to such resources by trail maintenance crews.	Through the ranger responsible for overseeing trail maintenance

Table 4-9 Potential Environmental Impacts and Measures to Prevent or Reduce Them (continued)

Impact	Measures to Prevent or Reduce Impact	Effect/ Effectiveness	Implementation
	3. Continued work shall be based on the advice of the archaeologist or cultural resources expert.		
Noxious Plants	1. Prepare a noxious weed management plan for Foothills Park that identifies infestations, prioritizes which areas are controlled first, and devises a protocol for addressing this issue over the long term.	1. Will organize the effort to control non-native invasive weeds in Foothills Park, and will help to prevent these species from degrading the ecosystem at Foothills Park.	Superintendent of Open Spaces and Sciences

5. The Trail Maintenance Program

The intent of this trail maintenance program is to provide "*clear passage*" throughout the trail system that will take into account, visitor safety, resource protection and the overall integrity of the trail system. The primary standard for this trail program is to perform trail work in a manner that minimizes resource damage and efficiently utilizes on-site materials. This program will not change the original purpose, intent or design of the existing Foothills Park trail system.

5. The Trail Maintenance Program

5.1 Trail Maintenance Defined

Trail Maintenance

Trail maintenance as defined here is the process of keeping a trail at or near the design standard set forth in this trails maintenance handbook. The overall objective in developing a comprehensive trail maintenance program for Foothills Park is to provide "clear passage" throughout the trail system that will take into account:

- Visitor safety
- Resource protection
- The integrity of the trail system

Trail maintenance activities include all the work required to correct any damage or disturbance to the trail and to adjacent vegetation and slopes. This type of work is not an alteration; it will not change the original purpose, intent, or design of the trail system.

Clear Passageway

A "*clear passageway*" as it relates to the Foothills Park trail system is defined as providing a means for the public to enter and have passage on foot through the variety of natural environments that the Park has to offer. As defined here, it also pertains to proving adequate means for authorized City maintenance and emergency staff to utilize the Park trails to perform necessary routine and emergency procedures.

5.2 Program Development

Trail Maintenance in the Natural Setting

The primary standard for trailwork in this handbook is one of environmental integrity. This means that the recommendations provided in this handbook look at trail maintenance activities from an environmental perspective, which allows natural processes to prevail. The recommendations in this handbook call for trail maintenance work to be undertaken in a manner that minimizes resource damage and efficiently utilizes on-site materials.

When staff establish their annual and cyclical trail work programs and determine the appropriate techniques for completing the work, they should strive to achieve a completed work effort that is pleasing to the eye and unobtrusive to the natural setting. Decisions should err on the side of environmental preservation. Completed sections of trail should be free of construction scars, provide for

maximum erosion control, encourage the growth of native vegetation and reduce future maintenance and resource rehabilitation needs.

Safety and Structural Integrity of the Trail System

Safety is central to all maintenance operations, and is the single most important trail maintenance concern. Understanding that there is a limited amount of money and labor for trail work, that work should be directed toward the conditions that have the potential to be the most hazardous to the public and are causing the most damage, or have the potential to cause the most damage, to the Park's unique natural resources.

Trail maintenance tasks should focus on protecting the structural integrity of the trail investment by restoring the trail to the standards prescribed in this trails maintenance plan or improving the trail, where necessary to provide a firm walking surface, that is located within a clear passageway.

This passageway should be maintained to be "*reasonably safe*" meaning it should generally be free from obstacles or hazards that hinder travel on the trail. Corrective actions may include repairing damage to a trail structure, which if neglected could develop into a situation where a trail could literally be washed away, thus jeopardizing visitor safety.

"Reasonably safe" does not, however, mean that that there will be no longer be any natural hazards associated with this natural foothills environment. For example, side slopes adjacent to the trail will generally not be altered and therefore, will continue to be steep. Rattlesnakes may still "share " the trail with park visitors, and native California poison oak will still be encountered within the trail corridor.

The Trail Inspection

Trail inspections are integral to all trail maintenance operations. Inspections should occur on a regularly scheduled basis, the frequency of which will depend on the amount of trail use, the location, age, and the types of structures and the types of soil/terrain. At a minimum, all trail and trail structures/features should be inspected at least once a year at the close of the winter "wet season". All trail inspections should be documented in writing in a field log.

These inspections will help identify public safety and resource management concerns, as well as routine maintenance needs. This process involves hiking each trail and noting the general condition of the trail bed and tread surface, as well as every structure (e.g. bridges, steps, benches, drain dips). Deficiencies should be noted and recorded into a field log.

Conditions that have the potential to be the most hazardous to the public, which should be watched for during field inspections, include:

- Over narrow trails, especially where there is a severe drop off
- Debris flows and landslides which have the potential to make the trail surface unstable or even impassable
- Aggressive natives, such as poison oak which could limit passage
- Heavy fuel loads which could create a high or critical danger fire hazard in the park
- Leaners and downed trees which could fall on trail visitors and/or block the passageway
- Damaged trail structures (e.g. bridges, handrails)

Conditions that have the potential to damage to the park's unique natural resources, which should be watched for during field inspections, include:

- Invasive non-native plants
- Loss of endangered, threatened or sensitive plant or animal species
- Loss of groundcovers which protect slopes from erosion
- Loss of existing overhead canopy which could alter the existing ecology of a site
- Heavy fuel loads which limit plant diversity
- Debris flows and landslides which could cause impacts to water quality and riparian habitat

For a sample checklist that could be used during field inspections refer to *Table 6-6 -Calendar of Trail Maintenance Activities* and *Table 6-7 – Sample Maintenance Log*. For a summary of existing conditions to look for refer to the *Summary Maintenance Tables 6-2 through 6-5* in *Section 6.5*. For illustrative and photographic examples of existing conditions that may be found on the trail and recommended corrective actions refer to Sections 6.6 – 6.10.

Developing and Maintaining a Maintenance Field Log

All trail inspections should be documented in writing in a field log. *Table 5-2 – Sample Maintenance Log* provides a sample maintenance field log for recording maintenance inspections, categorizing needed repairs and identifying completed tasks. Items for consideration in developing a maintenance log include scheduling work documenting timing of inspections. The log should provide information on the condition of the trail system including railings, bridges, and trail surfaces, proper and adequate signage. It should also document when repair work has been completed, debris has been removed and trails have been prepared for winter storms and spring/summer use.

Setting Priorities

Scheduling maintenance tasks is key to providing a consistently clean and safe trail system that will be enjoyed by park visitors. High quality and timely maintenance will greatly extend the useful life of a trail. The annual maintenance program may include various corrective maintenance actions, temporary closures, signing, monitoring and enforcement or a combination of these methods as determined during routine inspections. Since there will always be more work to do than there are resources, it is important to:

- Monitor trail conditions closely
- Decide what can be accomplished as basic maintenance
- Identify what areas will need major work.
- Determine what can be deferred

This analysis is important if maintenance dollars are going to be wisely allocated towards keeping most of the tread in the best possible condition.

The first priority for trail work is to correct truly unsafe situations. This could mean repairing or closing trails where impassible washouts and landslides have occurred along a precipitous section of trail.

The second priority is to correct conditions causing significant trail damage –erosion, sedimentation and off-trail trampling.

The third priority is to restore the trail to the planned design standards set forth in this handbook. This means that the ease of finding and traveling the trail matches the design intent for the recreational setting and the recreational user. Actions may range from simply adding trail directional/safety markers to fully reconstructing eroded tread or failed structures.

Whatever the priority, performing routine inspections and documenting maintenance requirements when the need is first noticed will help prevent more severe and costly damage later.

Annual Trail Maintenance

Once maintenance tasks have been identified in routine inspections and logged into the maintenance log, these tasks can be scheduled for correction through the annual maintenance program.

The annual maintenance program may include various corrective maintenance actions, temporary closures, signing, monitoring and enforcement, or a combination of these methods as determined during routine inspections. Ideally tread maintenance, drainage maintenance and vegetative management are

considered as part of the annual trail maintenance tasks and are performed as a unit. *Table 6-6 – Calendar of Maintenance Activities* provides a summary breakdown of routine tasks and timing for performing these work activities.

Cyclic Trail Replacement Projects

Construction, reconstruction, rehabilitation and restoration of trail facility maintenance projects (e.g. replacing signs, bridges) are considered cyclic long-range projects. These cyclic replacement projects are contingent on normal wear-out life spans. Storm damage, vandalism, and other uncontrollable acts can greatly reduce the life cycle of trail facilities and increase the frequency of replacement.

When the annual maintenance plan is prepared, long-range goals for maintenance, reconstruction and construction over a five to ten year period should also be considered. Unless a long-range work plan is addressed simultaneously with the annual plan, the annual plan will tend to lack direction, and will become a reaction-based plan responding to immediate problems without regard to long-term priorities. Long-range goals are absolutely essential to the efficient utilization of cyclic maintenance and construction funds and the use of volunteer groups on any appreciable scale. The long-range goals should be realistic, embracing not only what needs to be done, but also the probable means of accomplishment.

5.3 Staffing

City Staff- Roles and Responsibilities

Park Rangers –Staffing Levels

Park staffing is provided for the purpose of protecting and maintaining the open space parks within the City. Rangers that are based out of the Foothills Park office staff the foothills parks.

Currently there are two full time equivalent field staff persons budgeted to perform all of the maintenance and patrol functions at the park. They are scheduled to provide seven-day coverage. One ranger works full time at the park and two rangers allocate half their time (20 hours per week each) to the park. The remainder of each of these rangers time is allocated to duties at Arastradero Preserve.

Park Rangers – General Responsibilities

The Park Rangers, with support from other City Departments, are responsible for enforcement of the City's Municipal Code as it relates to patrolling, monitoring and maintaining Foothills Park. Their duties include: purchase, inventory, use,

training and repair of tools, uniforms and supplies; developing and leading outreach and interpretive programs; trail patrol, monitoring (including trail counts) and maintenance.

Park Rangers – Responsibilities as Trail Maintenance Crew Leaders

Trail maintenance work requires a unique set of skills. Rangers must be able to recognize and solve many kinds of trail problems caused by the interaction of environmental processes and by trail use. They must have the appropriate skills to perform manual and mechanized labor using minimal tools and available native materials. Crew leaders must use common sense and sensitivity. They must learn to recognize the unique features within a trail corridor and maintain that corridor, balancing environmental considerations and user needs. Crew leaders must have an understanding of soil conditions, a familiarity with native plants and how to maintain trails without harming fragile plants. And they must be able to oversee and convey their vision to youth crews and volunteer workers with widely varied work skills.

Rangers can best prepare to oversee work crews by conducting periodic, systematic inspections prior to initiating maintenance work. These inspections should focus on those conditions which have the potential to be the most hazardous to the public and are causing, or have the potential to cause, the most damage to the Park's unique natural resources. To this end the inspections should include: a pre-maintenance survey for sensitive biotic species, an evaluation of potentially unstable slopes for signs of failure, notation of trail segments which are exhibiting signs of overuse, and examination of fabricated trail components (e.g. water bars, benches, handrails, signs) for signs of failure and/or vandalism. The results of these inspections should be entered into the field log.

The required work should then be evaluated against the skill level of the work crew that the rangers will be overseeing. By carefully matching work tasks to workers, the rangers can see that trail maintenance is performed the most efficiently in terms of time and labor, the safety of the visitors is not jeopardized from work performed without the necessary skills and/or tools and materials at hand, and the resources in the area are not unduly harmed.

Staff Training

Properly training field employees is essential to the efficient operation of the trails maintenance program. All field employees should be thoroughly trained to understand and be aware of all the aspects of trail maintenance. Safety, a good work ethic, and proper care of equipment and tools will always be the backbone of a good training program. Field employees must also be aware of the need for positive public contact. Proper positive attitude towards public questions and

concerns is important, as is the conveyance of this information to trail work crews.

Overseeing Work Programs in the Park

Leading Field Activities

Park Rangers are responsible for overseeing the fieldwork of the California Conservation Corps (CCC) work program, as well as other the volunteer work programs at the Park. As part of this responsibility, park rangers must instill in the work crews that safety is the number one priority in all operations. Crew leaders are responsible for briefing crew members on how to maintain a safe working environment and instilling in them a sense of responsibility. They must be firm in establishing ground rules when working in the park, especially regarding the safe and appropriate use of tools. Every work leader must see that the safe work practices are adhered to, as improper use of tools is one of the chief causes of accidents in the field. Crew leaders and crew members should wear basic safety equipment. It is the responsibility of the crew leader to anticipate the safety requirements of the job and to make sure that appropriate safety gear is worn correctly. Injuries can be reduced significantly if safety hazards are anticipated and safety gear is used.

When overseeing young people, crew leaders will need to recognize that they may be working with youth that have little experience working in the woods. Supervision of these crews by rangers is crucial to the success of a youth work program. Rangers working as crew leaders will need to be especially tolerant of the experience level of their crews and work to empower youth with a "can-do" spirit. By exhibiting and instilling safety practices, a strong work ethic and a respect for the unique environment at Foothills Park, the staff can create a cooperative, effective work team.

California Conservation Corps (CCC)

California Conservation Corps – Organization & Responsibilities

The California Conservation Corps (CCC) has provided maintenance support for the City's open space areas since1985. The Open Space Division renewed a contract with CCC for a 3-year period beginning July 1, 2000-2003. The CCC work crews are comprised of crew leaders and crewmembers. As the CCC is a job training program for youth, these work crews change from project to project, and many do not return to the same Park year after year.

Corps members are trained through two methods: project work and classroom/field instruction. This approach has proven effective in teaching young adults trail construction, trail maintenance and environmental preservation.

"*Education days*" are days away from field where the crew attends formal instruction. In classroom instruction, Corps members attend a *Conservation Awareness* class during their basic academy, which includes instruction in native and endangered plant preservation, and management of exotic vegetation.

Classroom instruction is supplemented with the "*project work program*", which was developed to provide on-the-job training. Foothills Park trails maintenance projects are performed under this *"project work program"*. The City rangers and CCC staff serve as crew leaders providing instruction and guiding the youth crew members in a variety of field operations pertaining to trail building and habitat enhancement, including replacement of native plants in disturbed sites. Within Foothills Park, CCC trail work tasks include:

- Trimming trees and shrubs away from the borders of trails
- Removing poison oak
- Resloping the trail bed and building water bars to improve drainage
- Clearing weeds from trail tread and planting appropriate native plants along disturbed corridors
- Maintaining, restoring, and where necessary, replacing trail infrastructure including: wooden foot bridges, steps, trail signs and markers, split rail fences and retaining walls.

City Rangers - California Conservation Corps Coordination

Due to limited staffing at the park, these CCC work programs form the core of the park maintenance program and ranger staffing is instrumental to the success of these programs. Ranger responsibilities for the CCC programs include:

- Initial field reviews with CCC crew leaders and volunteers to identify and flag rare plants
- Daily field meetings with CCC crew during each trail maintenance project to monitor trail work performed by CCC to ensure that they are complying with established trail standards, while taking care to preserve rare, endangered and sensitive species
- Follow-up evaluations of each trail maintenance project with CCC crew leaders.

Other Work Partnerships

Volunteers - Trail Corridor Restoration Work

Volunteers provide another opportunity to contribute to the maintenance of Foothills Park. One such group is the *Friends of Foothills Park*. The primary interest of this group is native plant restoration. Their work has been focused on the removal of non-native, invasive plants. They coordinate their activities with the Open Space staff. Their park restoration work includes:

- Clearing invasive plants

- Clearing invasive plants
- Identifying and flagging sensitive plants prior to the CCC initiating trail work
- Brushing sensitive trails.

Digging, removal or cutting of park plants is not permitted without the written consent of the Superintendent of Open Space and Sciences.

Other volunteers could initiate other trail-oriented maintenance programs. The Open Space staff should work closely with new volunteers to establish work programs that are directed to fit with each volunteer group's interests and skill levels.

Other Staff Duties Related to Park Protection & Trail Activities

Response to Fire and Medical Emergencies within the Park

While the primary responsibility for fire and medical emergencies lies with the City Fire Department, Park Rangers will typically be the first response team for fire and medical emergencies within the Park. Foothills Park Rangers have received various limited levels of fire fighting training and are dispatched as a resource to fires and other emergency calls. They are a valuable resource as they provide enhanced local knowledge of the area, and can be used to augment Engine Eight or to perform other tasks, such as evacuation or reconnaissance. The Palo Alto Fire Department has rated the Rangers control of public areas and Park maintenance practices, which augment the City's fuel management system as outstanding (Palo Alto Draft Fire Management Plan, April 1997).

As part of the City's *Pre-Suppression Plan – Fire Breaks/Ignition Control Plan,* Rangers participate in an annual pre-fire season briefing with Fire staff. At this briefing they coordinate activities (e.g. maintaining firebreaks and evacuation routes and rehabilitating specific sites that may have been impacted by fire or emergency operations). They also review existing procedures for adequacy and effectiveness.

Naturalist Programs

Park Rangers, City Naturalists and the *Friends of Foothills Park* schedule guided nature walks, slide shows and trail maintenance/habitat restoration workshops throughout the year. Frequently these events are held at or begin from the Interpretive Center is which contains park/trail maps, a model of the park, natural science exhibits, a lounge, the ranger's offices and restrooms.

6. Trail Maintenance Guidelines – Techniques & Tools

The guidelines in this section of the trail maintenance handbook are intended to document practices that have been effective and to provide guidelines for correcting current trail deficiencies and damage from inappropriate management techniques. Additionally, these guidelines provide recommendations for monitoring and/or conducting special studies in areas with major environmental constraints and/or trail failures to minimize future impacts to sensitive resources.

6. Trail Maintenance Guidelines - Techniques and Tools

6.1 Overview

The Purpose of These Guidelines

The existing 15 – mile trail system was developed almost forty years ago. As a testimony to the initial construction and ongoing use and maintenance practices, most of the trail system is still in good condition and is functioning quite well. In accordance with its original purpose, this trail system continues to provide a variety of hiking opportunities that allow people to experience the diverse ecology of Foothills Park.

The guidelines in this section of the trail maintenance handbook are intended to document practices that have been effective for correcting current trail deficiencies and damage from inappropriate management techniques. Additionally, these guidelines provide recommendations for monitoring and/or conducting special studies in areas with major environmental constraints and/or trail failures to minimize future impacts to sensitive resources.

These are guidelines. They provide general direction, but cannot be substituted for field investigations by experienced crew leaders to address specific site conditions and good craftsmanship by the field crews. An experienced crew leader will demonstrate an understanding of the site by developing a maintenance work plan that may include for example, a minor reroute of a trail segment to avoid a wet area or retention of a specimen tree that encroaches into the trail tread but adds to the overall character of the trail. Good craftsmanship is illustrated by the extra effort spent on finishing touches that will pay off in a more natural looking trail that is pleasing to the eye. Examples include widely scattering cut vegetation, blending backslopes, raking leaves back over fill slopes, and restoring barrow sites.

If the recommendations provided in this handbook are performed with attention to the desired result, on a routine basis, they will typically result in minimizing resource impacts and public hazards and lower the need for major, ongoing expensive and labor-intensive, corrective maintenance.

6.2 Using These Guidelines – A Summary of the Techniques &Tools Found in this Section

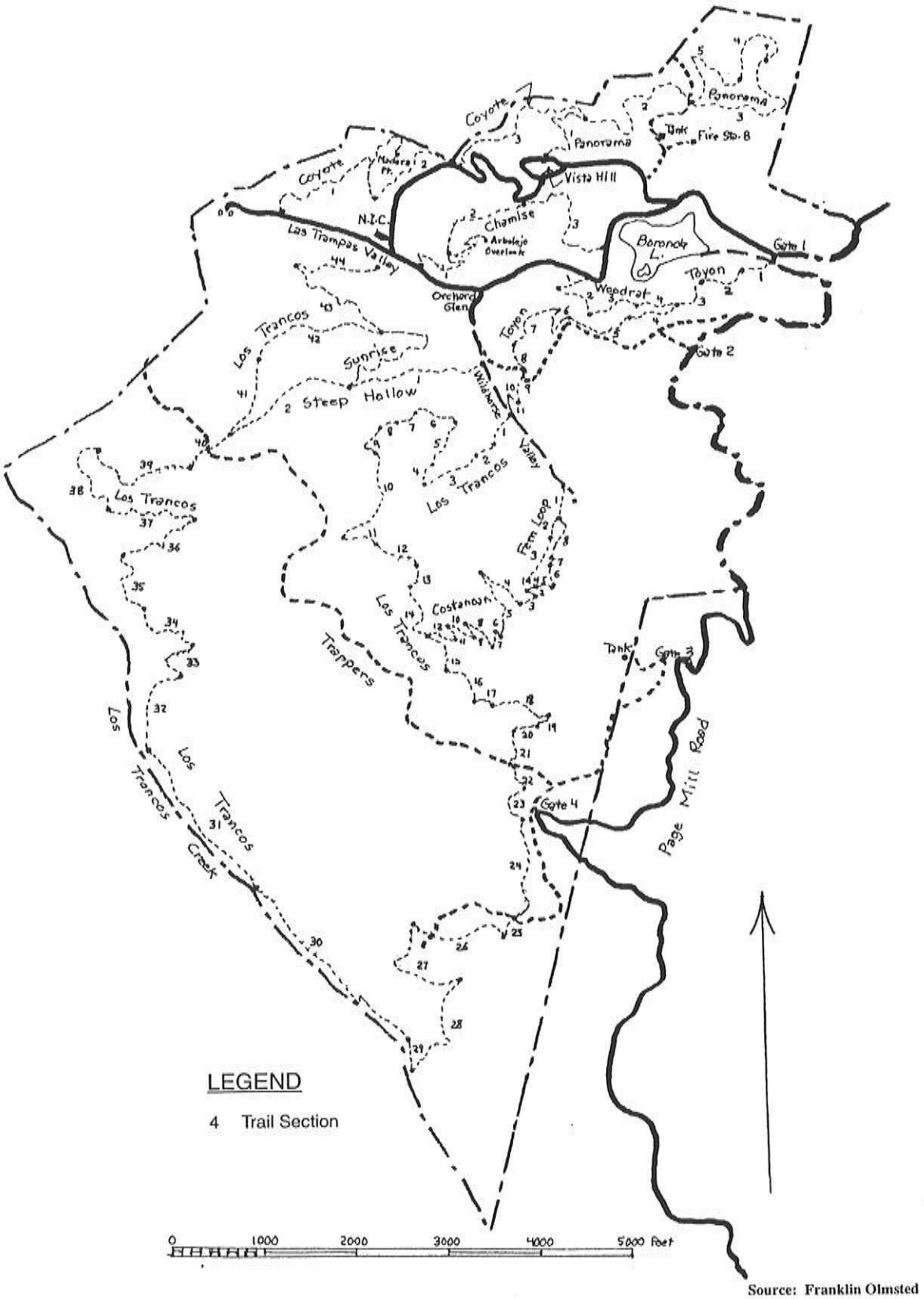
The recommendations in this handbook call for trail maintenance work to be undertaken in a manner that minimizes resource damage and efficiently utilizes on-site materials. Trail maintenance tasks should focus on protecting the structural integrity of the trail investment. Completed sections of trail should be "*reasonably safe*" meaning they should generally be free from hazards that could hinder travel on the trail, The completed work effort should be pleasing to the eye and unobtrusive to the natural setting. When determining what actions should be undertaken to maintain the trails in Foothills Park, decisions should err on the side of environmental preservation.

For a more comprehensive discussion on resource management objectives refer to *Sections 3.4 Natural Resources Management Objectives Adjacent to the Trail, 4.8 Potential Environmental Impacts and Measures to Prevent or Reduce Impacts and 5.2 Program Development - Trail Maintenance in the Natural Setting.*

Sub-sections 6.5 – 6.11 form the technical portion of this handbook. These sub-sections of the handbook were developed as reference tools, which can be used to supplement the knowledge of experienced field staff. They have been designed to be used when specific conditions are encountered in the field that require corrective action. These sub-sections include descriptions, photos and illustrative diagrams showing typical conditions requiring routine corrective action and examples of trail surface improvements, drainage structures, bridges, and guidelines for managing vegetation.

As an easy reference an index sheet has been provided at the beginning of each sub-section on techniques and tools. These maintenance guideline sub-sections are divided according to:

- The trail surface – correcting the tread width and surface, grading and drainage
- Infrequent conditions on hiking trails that require special management
- Vegetation – pruning, limbing and clearing, resource protection, rehabilitation and enhancement
- Los Trancos Creek Corridor - trail maintenance as it relates to creek resources
- Trail structures – bridges, steps, benches
- Signs, guides, maps and programs



Source: Franklin Olmsted

For planning Purposes only.
All boundary and trails are based on unscaled data provided by others
Amphion takes no responsibility for accuracy of map

Map 6-1 FOOTHILLS PARK - Trail Sections Linked to Existing Trail Characteristics Table

6.3 Summary Overview of Existing Conditions

Following is a table summarizing the existing trail conditions for the individual hiking trails that make up the Foothills Park trail system. These tables include the trail length, width and habitat type for each of the trails in the Park. This table is keyed to *Map 6-1 Trail Sections Linked to Existing Trail Characteristics.*

Table 6-1 Foothills Park - Summary of Existing Trail Characteristics

Chamise Trail Characteristics

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
1a	193.0	+9	southwest	10-20	valley side/hill slope	oak woodland	3.3-4.3
1b	183.3	+9	south	25-30	hill slope	oak woodland	2.8-5.2
1c	281.0	-----	southwest	25-30	hill slope	oak woodland	3.3-4.7
1d	241.1	-----	southeast	30	hill slope	chaparral	3.0-5.0
1e	175.6	-----	south	30	hill slope	chaparral	3.0-5.4
1f	147.3	-----	west	30-35	hill slope	chaparral	3.3
TOTAL 1a-f	1,221.3	+11	southeast/west	10-35	mostly hill slope	oak woodland/chaparral	2.8-5.4
2a	465.8	-----	northwest	20-25	hill slope/swale	oak woodland	3.1-4.0
2b	708.6	-----	south	10-15	flat/hill slope	grassland/chaparral	2.4-4.0
TOTAL 2a-b	1174.4	+4	south/ northwest	10-25	flat/hill slope	grassland/woodland/ chaparral	2.4-4.0
3a	298.2		southeast	20-25	hill slope	grassland	2.2-4.0
3b	126.9		south	30	hill slope	grassland	2.5-3.0
3c	199.4		west	30-35	hill slope	grassland	2.3-3.3
3d	249.6		west	25	hill slope	woodland/chaparral	2.5-3.6
3e	215.4		west	35	hill slope	woodland	3.0-3.8
3f	201.4		south	25	hill slope	chaparral/woodland	3.3-5.0
3g	266.5			25	hill slope	chaparral/woodland	3.0-3.9
3a-f	1,557.4	-2	southeast/west	10-35	Hill slope	grassland/woodland/ chaparral	2,2-5.0
TOTAL 1-3	3,953.1	+3.5	southeast/ northwest	10-35	mostly hill slope	woodland/chaparral/ grassland	2.2-5.4

Costanoan Trail Characteristics

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
TOTAL	4,410				hill slope	woodland/chaparral	2-4 (avg. 2.9)

Coyote Trail Characteristics

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
1a	198.9		south	5	valley side	grassland/oak savanna	3.1-4.3
1b	72.1		south	15-20	hill slope	oak savanna	4.2
1c	271.2		south	15-20	hill slope	oak savanna	3.2-4.4
1d	212.9		south	15-20	hill slope	oak savanna	3.0-3.6
`e	61.4		south	15-20	hill slope	oak savanna	2.9-3.1
1f	161.3		southeast	15-20	hill slope	oak savanna	3.8-5.1
1g	191.9		southeast	15-20	hill slope	oak savanna	2.7-3.6
1h	194.6		southeast	15-20	hill slope	oak savanna	2.8-3.1
1i	91.9		southeast	15-20	hill slope	oak savanna	2.8-3.2

Table 6-1 Foothills Park - Summary of Existing Trail Characteristics (con't.)

Coyote Trail Characteristics (continued)

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
1j	433.0		west	10-15	hill slope	oak savanna	3.1-4.1
TOTAL 1a-j	1,889.2		southeast	5-20	hill slope	grassland/oak savanna	2.7-5.1
2a	194.0		southeast	15-20	hill slope	woodland	2.7-4.4
2b	361.0		east	15-20	hill slope	chaparral/woodland	3.5-5.0
2c	184.2		east/southeast	15-20	hill slope	woodland	3.2-3.9
2d	527.6		east	-----	gentle slope	woodland/grassland	3.1-5.0
TOTAL 2a-d	1,266.8		east/southeast	flat to 20	hill slope	woodland/chaparral/ grassland	2.7-5.0
3a	129.7		southwest	-----	hill slope	grassland	5.0
3b	270.8		northwest	-----	hill slope	woodland/grassland	3.8-5.2
3c	383.5		north	20-25	hill slope	woodland	3.3-4.0
3d	173.2		north	25-30	hill slope	woodland	3.0-3.2
3e	285.4		west	25-30	hill slope	woodland	3.5-3.8
3f	325.1		north	25-30	hill slope	woodland	3.0-3.9
3g	292.2		north	25-30	hill slope	woodland	3.2-4.2
3h	297.8		north	25-30	hill slope	woodland	3.3-4.3
TOTAL 3a-h	2,157.7		southwest/ north	20-30	hill slope	woodland/grassland	3.0-5.2
TOTAL	5,313.7						2.7-5.1

Fern Loop Trail Characteristics

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
1	312.7	-----	Flat	-----	valley bottom	grassland	3.5-5.0
2	223.3	-----	Flat	-----	narrow valley bottom	woodland/grassland	3.0-4.2
3	572.9	-----	south	30	ravine side	woodland	2.3-4.0
4	227.6	-----	south	20	ravine side	woodland	3.3-4.2
5	251.9	-----	north	20	hill slope	woodland	3.2-3.9
6	79.6	-----	north	20	hill slope	woodland	3.2-3.7
7	133.2	-----	southeast/east	35	hill slope	woodland	2.2-4.2
8	869.6	-----	north	35	ravine side	chaparral/woodland	2.6-4.9
1	312.7	-----	-----	-----	valley bottom	grassland	3.5-5.0
TOTAL	2983.3	-----	-----	-----	----------	-----	2.2-5.0

Los Trancos Trail Wildhorse Valley to Upper Trappers Trail Crossing

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
1	474.2	7-10	flat	Flat	wildhorse valley	disturbed grassland	4.3-6.4
2	235.4	6-8	flat	Flat	ravine edge	bay woodland	3.2-6.9
3	637.1	8-15	northwest	30-35	hill slope	mixed woodland	3.2-5.4
4	245.3	5-11	southeast	30-35	hill slope	mixed woodland	2.7-5.5
5	557.8	5-11	north/ northeast	35-40	hill slope	chaparral	3.6-5.0
6	624.9	0-10	northwest/ north	0-25	hill slope/swale	chaparral/woodland	3.8-4.2
7	235.7	10-15	north/ northeast	20-30	hill slope	chaparral/woodland	3.2-5.1
8	220.0	15-22	northwest	30	hill slope	dense chaparral	2.5-5.1
9	600.4	0-20	north	0-15	hill slope	mixed woodland	2.5-6.9

Table 6-1 Foothills Park - Summary of Existing Trail Characteristics (con't.)

Los Trancos Trail Wildhorse Valley to Upper Trappers Trail Crossing

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
TOTAL 1-9	3,830.8	9.8					
10	1,048.3	0-10	southeast	0-30	level/ hill slope	chaparral/woodland	2.1-3.6
11	606.5	3-5	north/ northeast	25-30	hill slope	woodland/chaparral	2.1-3.8
12	560.4	0-8	east/ southeast	0-30	hill slope/swale	chaparral/woodland	2.1-3.8
13	283.1	0-5	flat	Flat	broad terrace	chaparral	2.1-2.5
14	733.6	0-10	east/ northwest	0-30	hill slope/ terrace	chaparral/woodland	1.9-3.8
TOTAL 10-14	3,231.9	8.4					1.9-3.8
15	714.0	---	east/south	25-35	hill slope	woodland/chaparral	2.5-3.6
16	723.8	---	east/south	35-40	hill slope	woodland/chaparral	2.5-3.7
17	341.9	---	northeast/ southeast	30	hill slope	woodland	2.3-4.1
18	698.7	---	east/south	25-35	hill slope	chaparral/woodland	1.9-4.6
19	156.9	---	southwest /northwest	35	hill slope	chaparral/woodland	2.4-3.0
20	209.7	---	northwest	35	hill slope	chaparral/woodland	2.7-3.6
21	694.9	---	south/ southwest	15-25	hill slope	chaparral	1.9-4.6
TOTAL 15-21	3,539.9						1.9-4.6
22	377.9						
23	587.6						
24	1,356.1						
TOTAL 22-24	2,321.6						2-4
25	346.9						-2-4+ (avg. 2.8)
26	1,190.2						-2-4+ (avg. 2.6)
27	1,440.5						-2-4+ (avg. 2.6)
28	1,417.8						-2-4+ (avg. 2.6)
TOTAL 25-28	4,395.4						-2-4+ (avg. 2.6)
29	467.2						-2-4+ (avg. 2.3)
30	2,704.2						-2-4+ (avg. 2.3)
31	2,190.4						-2-4+ (avg. 2.3)
TOTAL 29-31	5,361.8						-2-4+ (avg. 2.3)
32-35	3,617						-2-4+ (avg. 2.4)
36-38	3,412						2-4
39-40	1,954						-2-4+ (avg. 3)
41-42	2,648						2-4+ (avg. 3.5)
43-44	2,439						2-4+ (avg. 3.6)

Table 6-1 Foothills Park - Summary of Existing Trail Characteristics (con't.)

Panorama Trail Characteristics

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
1a	261	18	north	20	hill slope	grassland	2.5-3.0
1b	248	16	northeast	20	hill slope	grassland	2.0-2.5
1c	197		northeast	25	hill slope	oak woodland	3.5-4.0
1d	133		north	25	hill slope	oak woodland	3.5-4.0
1e	348		north	25	hill slope	oak woodland	3.5-4.0
1a-e	1,187		north/ northeast	20-25	hill slope	grassland/woodland	2.0-4.0
2a	486		north	25	hill slope	oak woodland	3.0-3.5
2b	379		west	25	hill slope	woodland/grassland	2.0-3.0
2c	369		north	20	hill slope	oak woodland	2.5-3.5
2d	653		north	20	hill slope	woodland/grassland	2.0-3.0
TOTAL 2a-d	1,887		west/ north	20-25	hill slope	woodland/grassland	2.0-3.5
3a	985		north	20	hill slope	woodland/grassland	2.0-2.5
3b	234		west	15	hill slope	woodland	2.0-3.5
3c	430		west	15	hill slope	woodland/grassland	2.0-3.0
3d	338		flat	-----	Bobcat Point	chaparral/woodland	3.0-4.0
TOTAL 3a-d	1,987		north/west	15-20	hill slope	woodland/chaparral/ grassland	2.0-4.0
4a	671		east/ north	30	Bobcat Point	chaparral	2.5-4.0
4b	465		west	25	hill slope	chaparral/woodland	3.0-4.0
TOTAL 4a-b	1,136		east/ north	25-30	Bobcat Point/ hill slope	chaparral/woodland	2.5-4.0
5a	196		north/west	30	hill slope	woodland	4.0-5.0
5b	597		northwest	30	hill slope	woodland	3.0-4.0
5c	744		southwest/ northwest	30	hill slope	woodland/grassland	2.5-4.0
TOTAL 5a-c	1,537		southwest/ northwest	30	hill slope	woodland/grassland	2.5-5.0
TOTAL	7,753			15-30	mostly hill slope	woodland/grassland/ chaparral	2.0-5.0

Steep Hollow Trail Characteristics

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
TOTAL	3,179				hill slope	woodland/grassland/ chaparral	3-4+ (avg. 3.6)

Sunrise Trail Characteristics

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
TOTAL	1,695				hill slope	woodland/grassland/ chaparral	3-4+ (avg. 3.6)

Toyon Trail Characteristics

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
1	497	8-12	northwest/ north	25-30	hill slope	woodland	3.2-5.0
2	450	5-10	northwest/ north	25-30	hill slope	woodland	3.2-5.2
3	322	2-4	west/ north	30	hill slope	woodland/chaparral/ grassland	3.7-6.6
4	659	0-3	northwest/ northeast	30	hill slope	woodland	3.2-4.9
5	774	0-2	northwest/ northeast	20-30	hill slope	woodland/chaparral	2.9-5.1
6	621	0-12	west	0-25	ridge-top/hill slope	chaparral/woodland	3.0-5.9

Table 6-1 Foothills Park - Summary of Existing Trail Characteristics (con't.)

Toyon Trail Characteristics

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
7	764	11-15	northwest	15-25	hill slope/ravine/ nose	woodland/chaparral	3.0-5.1
8	296	6-10	southwest	20-25	hill slope/edge ravine	chaparral	3.6-5.2
9	452	7-10	west/ northwest	20-30	hill slope	chaparral/woodland	2.9-5.3
10	139	10	southwest	20	hill slope	chaparral/woodland	3.5-5.2
11	286	0-9	southwest	20-25	hill slope	woodland	2.9-4.0
TOTAL	**5,260**	**0-15**					**2.9-6.6**

Woodrat Trail Characteristics

Section	Distance (feet)	Grade (percent)	Slope aspect	Slope angle (degrees)	Topography	Plant community	Ex. trail width (ft)
1	356	10-14	north	25	hill slope	woodland	3.6-4.9
2	553	0-15	north/east	25	hill slope	woodland	2.8-4.3
3	607	0-6	northwest/ northeast	25-30	hill slope	woodland	2.9-4.6
4	518	3-11	north	30-35	hill slope	woodland	3.0-4.3
TOTAL	**2034**	**10.6**	**northwest/ east**	**25-35**	**hill slope**	**woodland**	**2.8-4.9**

Source: Franklin Olmsted 2001-2002

Note: The trail data provided in this table was evaluated in the field by Franklin Olmsted. The information provides a representation of the general character of the trail system, but the table is not all inclusive. It does not describe all of the characteristics for the following trails: Costanoan, Los Trancos Trail, Steep Hollow, Sunrise. It does not include any data for Trappers Trail.

6.4 Trail Structure Terminology Defined

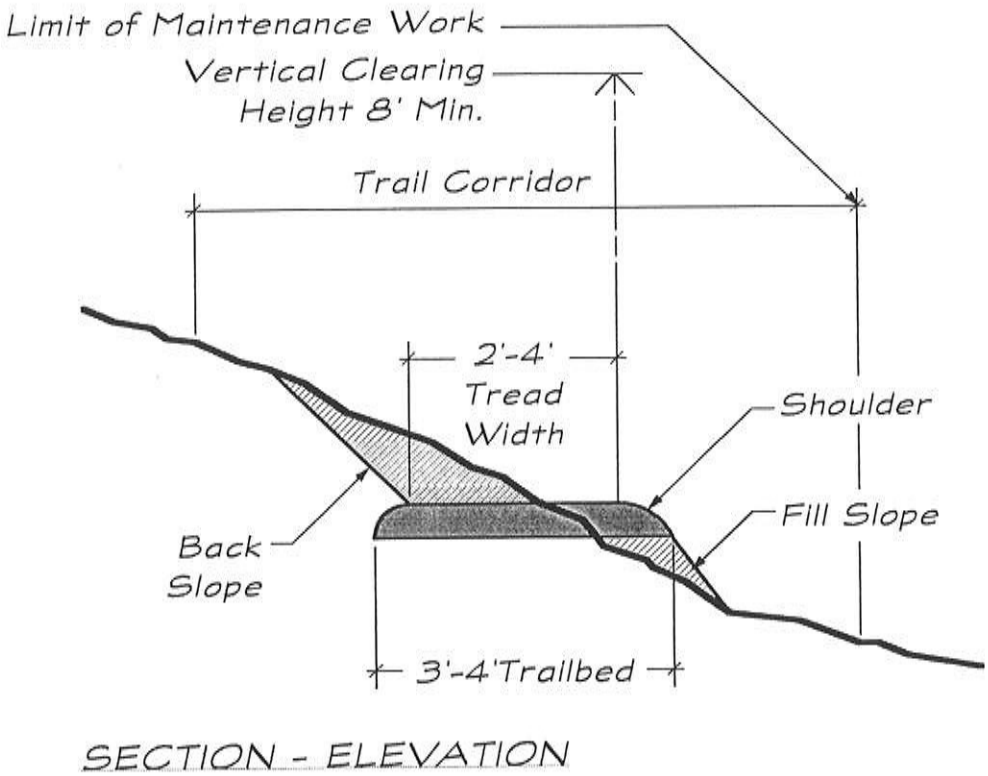


Figure 6-1 Trail Terminology

A trail for the purposes of this handbook, consists of the ***trail tread,*** the ***trail bed*** and the ***trail corridor.***

Trail Tread

The *trail tread* is the portion of the trail on which people actually travel. The *trail tread* is typically the native earthen surface, but it may also be hard bedrock or crushed rock, which has been compacted into the soil tread. The *trail tread* should generally be maintained to provide a 2-foot (minimum) to 4-foot wide travelway.

Trail Bed

The *trail bed* encompasses the trail tread, along with the soil "shoulder" and any subsurface improvements placed underneath and around the trail tread. The *trail bed* encompasses the entire constructed area of the trail. The *trail bed* may include structures that are essential to maintaining the integrity of the trail, but may not be noticed by average visitor. Generally, the sub-grade of the Foothills Parks trails

will not be altered and trail tread will be native soil, so the *trail bed* and the *trail tread* will be indistinguishable. In Foothills Park the *trail beds* of existing trails range between 18 inches to 5 feet wide feet wide.

Trail Corridor

The *trail corridor* is an imaginary three-dimensional zone, which includes the trail bed and areas above and to the sides of the trail. The *trail corridor* is the area in which most of the vegetation management activities take place, and is the area that provides the greatest potential for controversy over appropriate actions that should be undertaken to maintain a clear passageway.

6.5 Management Strategies for Maintaining Hiking Trails

Management Strategies by Vegetation Type

The diversity of the park's environment presents a wide variety of trail maintenance and reconstruction requirements. The movement of water during winter storms affects all trails and the ongoing maintenance of the trail drainage system is a major component of a trail maintenance program. Vigorous vegetation growth of species such as poison oak will likewise occupy much of the maintenance crews' time. Additionally, heavily used trails may suffer from the impacts of that use, including the development of ruts in the trail tread and damage to switchbacks or adjacent terrain from visitors shortcutting.

Strategies for addressing trail maintenance and trail reconstruction are covered in this section. Summary tables 6-2 to 6-5 provide an overview of maintenance strategies for each of the vegetation types. An analysis of typical trail deficiencies and recommended tools and techniques to correct these situations are grouped according the trail tread, trail drainage, vegetation management, trail structures and communication tools.

Using the Maintenance Summary Tables

On the following pages are a series of summary tables describing management strategies for maintaining the hiking trails. These tables have been organized according to the varied vegetation communities found within Foothills Park because this will be the most distinguishing feature when establishing strategies for maintaining this trail system. These habitat types include Grasslands/Oak Savanna, Chaparral Vegetation, Bay Woodlands and Mixed Woodlands. Each of these tables is then keyed to the figures and text in this section. The figures and text describe typical existing conditions requiring routine corrective action and recommended techniques and tools for maintaining the trail system.

Table 6-2 Managing Trails within Grasslands/Oak Savanna

Existing Conditions & Recommended Corrective Maintenance Actions
(Applies to Chamise Trail, Coyote Trail, Fern Loop, Los Trancos Trail, Panorama Trail)

Maintenance Area	Typical Conditions	Conditions to Watch For	Soils Management Recommended Corrective Actions	Vegetation Management Recommended Corrective Actions
Trail Tread	Clear passage for walking 2'-5 ' wide	Entrenched Trail– See Fig. # 6-4	Correct tread by removing soil berms where there is an outside edge & filling gullies. Figs. #6-7, #6-8 Timing – July, August Outslope trail bed where feasible & provide drain dips or water bars to dissipate water – See Figs. #6-8, 6-14, 6-15 Timing – fall, mid-winter, spring Correct switchback which may be leading to "short cutting" & close "volunteer trails by breaking up the compacted soils & reestablishing native vegetation – See Figs #6-4,6-10 Timing – July, August	Remove vegetation within trail tread – See vegetation/ground plane below Figs. #6-22, 6-23 Timing – May, June, July
		Overuse - See discussion pg. 6-31	Add &/or retain a variety of organic & inorganic materials to strengthen native soil surfaces. Add edging to contain materials & strengthen trail edge – See Fig. #6-7, 6-10, 6-16 Timing – July, August,	

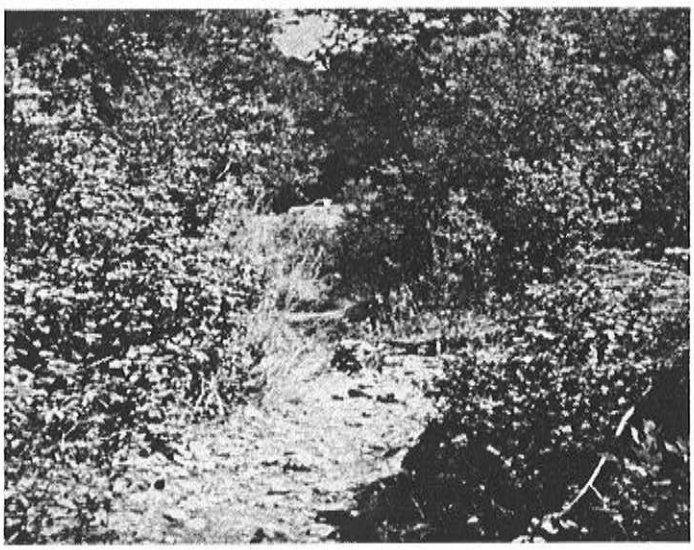
Table 6-2 Managing Trails within Grasslands/Oak Savanna (continued)

Maintenance Area	Typical Conditions -	Conditions to Watch For	Soils Management Recommended Corrective Actions	Vegetation Management Recommended Corrective Actions
Trail Bed	Median width of trail bed 3.8' - Areas of extensive sloughed material within trail bed	Inconsistency in trail width	Where passage is less than 2 feet & side slope is compromising visitor safety cut back upslope & add a low retaining wall on outside edge– See Fig. #6-10 Timing – July, August	Where trail is overwide, break up compacted soils & reestablish native vegetation to narrow tread width to 4 feet– See Fig. #6-12 See discussion pg. 6-35, 6-37, 6-51 Timing – March, October (optimal)
			Where over narrowing is caused by loose material sloughing onto the trail, remove & spread excess material from the uphill slopes over the width of the trail to produce the intended width & promote positive drainage.– See See discussion pg. 6-34, 6-39 Timing – July, August	
		Areas where water is collecting	Correct areas of standing water by building up the tread & filling low area with rock. Top with native soil.– See Fig. # 6-16 Timing – July, August	
			And where necessary to dissipate water on slopes, add drain dips &/or water bars Figs. 6-14, 6-15 Timing – fall, mid-winter, spring	
Trail Corridor/ Side Slopes	Side slopes highly variable	Areas of loose rocks	Remove loose rocks & roots that are jeopardizing visitor safety - fill holes to restore positive drainage patterns See discussion pg. 6-39 Timing – July, August	
		Areas where people have created shortcuts through grasslands	Where volunteer trails are cutting through trail corridors improve design of existing switchbacks to promote use of designated trails. – See Fig. #6-11 Timing – July, August	Where volunteer trails are cutting through trail corridors scarify & revegetate to remove evidence of trail See Fig. #6-12 Timing – October
		Occurrences of endangered, threatened & sensitive species See Table 4-4 for a listing of known and possible occurrences based on habitat in the trail corridor		Conduct pre-maintenance survey & flag sensitive plants See discussion Section 4.4 for appropriate management strategies where nesting birds & mammals are found See Section 4.4 & pg. 6-51 for discussion on protecting native vegetation Timing – Conduct surveys Feb.-Oct. prior to initiating maintenance activities

Table 6-2 Managing Trails within Grasslands/Oak Savanna (continued)

Maintenance Area	Typical Conditions -	Conditions to Watch For	Soils Management Recommended Corrective Actions	Vegetation Management Recommended Corrective Actions
Vegetation–Ground Plane	Mix of native and exotic grasses, mix of annual perniannal ground covers & invasive, exotics	Low plants encroaching into the trail Occurrences of endangered, threatened & sensitive species See Table 4-4 for a listing of known and possible occurrences based on habitat in the trail corridor Invasive, exotics overtaking trail edge		Remove plants & loose roots within the *trail tread* See Fig. #6-22, #6-23 Timing – July, August Low growing & slow growing shrubs & ground cover on the uphill & lower sides of the *trail corridor* generally should not be disturbed. See Section 4.4 & pg. 6-56 Timing – Conduct surveys Feb.-Oct. prior to initiating trail maintenance & vegetation management activities Establish program for managing stands of aggressive non-natives – See discussion Section #4.5 Timing – April, May
Trail Vegetation–Middle Plane	Middle plane is intermittent	Brush that intrudes into the passageway		Generally Not Applicable – where woody shrubs do occur along the trail edge work with natural vegetation patterns to "feather" or meander the edges of clearing work so it will have natural appearance See discussion pg.6-59 Timing – May, June, July
Vegetation–Overhead Canopy	Almost non-existent - except where trail passes through the oak savanna	Overhang limbs, leaners & downed Trees		Generally Not Applicable- Within stands of oaks cut overhanging limbs & downed trees & remove leaners to provide a clearing 4' wide & 8' high. See Fig. #6-25 See discussion pg. 6-62 Timing – All months as needed for hazard abatement and user safety

Table 6-3 Managing Trails within Chaparral



Existing Conditions & Recommended Corrective Maintenance Actions
(Applies to Chamise Trail, Coyote Trail, Fern Loop, Panorama Trail, Toyon Trail)

Maintenance Area	Typical Conditions	Conditions to Watch For	Soils Management Recommended Corrective Actions	Vegetation Management Recommended Corrective Actions
Trail Tread	Clear passage for walking 2'-5 ' wide	Entrenched Trail – See Fig. #6-4 Overuse - See discussion pg. 6-31	Correct tread by removing soil berms where there is an outside edge & filling gullies – See Fig. #6-7, #6-8 Timing –July, August Provide drain dips or water bars to dissipate water – See Fig. #6-14, #6-15 Timing – fall, mid-winter, spring Add &/or retain a variety of organic & inorganic materials to strengthen native soil surfaces. Add edging to contain materials & strengthen trail edge – See Fig. #6-10, #6-16 Timing – July, August	Remove vegetation within trail tread – See vegetation/ground plane below See Fig. #6-22, #6-23 Timing – May, June, July
Trail Bed	Median width of trail bed 3.6' Mix of conditions including areas protruding bedrock within trail bed & overwide (>4') wide trail bed	Inconsistency in trail width	Where passage is less than 2 feet & side slope is compromising visitor safety cut back upslope & add a low retaining wall on the outside edge See Fig. #6-10 Timing – July, August	Where trail is overwide scarify & revegetate to narrow tread width to 4 feet See Fig. #6-12 See discussion pg. 6-35, 6-37, 6-51 Timing - October

Table 6-3 Managing Trails within Chaparral (continued)

Maintenance Area	Typical Conditions -	Conditions to Watch For	Soils Management Recommended Corrective Actions	Vegetation Management Recommended Corrective Actions
Trail Bed (continued)	Protruding bedrock base		Note features in universal trail assessment so hikers will be aware that the trail surface is uneven in these areas See Fig. #6-39, #6-43	
Trail Corridor/Side Slopes	Side slopes generally heavily vegetated with mix of dense woody shrubs 3'–10' high	Heavy fuel loads Extensive stands of poison oak	When establishing fuel reduction and poison oak management programs do not over groom to the extent that erosion of side slopes will accelerate See discussion pg. 6-60, 6-61 Timing – March, May, June, July	When pruning to reduce fuel loads and clear poison oak, leave low ground covers and a layer of leaf litter/duff to minimize future erosion See discussion pg. 6-56, 6-61 Timing – October
Vegetation–Trail Vegetation–Ground Plane	Ground covers mix of natives & Groundcovers a mix of natives & invasive exotics	Occurrences of endangered, threatened & sensitive species See Table 4-4 for a listing of known and possible occurrences based on habitat in the trail corridor Invasive, exotics overtaking trail edge where edges have been disturbed See Table 4-6 for a list of noxious plant species		Conduct pre-maintenance survey & flag sensitive plants See discussion Section 4.4 for appropriate management strategies where nesting birds & mammals are found See Sections 4.4, 6.4 for discussion on protecting native vegetation Timing – Conduct surveys Feb.-Oct. prior to initiating trail maintenance & vegetation management activities Establish program for managing stands of aggressive non-natives – See discussion Section # 4-5 Timing – April, May
Trail Vegetation–Middle Plane	Middle plane is mix of dense woody shrubs 3' –10' high	Brush that intrudes into passageway – special watch for aggressive natives (e.g. poison oak) that can overtake the trail & diminish visitor's experience		Where aggressive natives (e.g. poison oak) are overtaking the trail, brush trail corridor to provide clear passage - See Discussion pg. 6-61 Timing – Feb., March, May, June, July In other areas work with natural vegetation patterns to "feather" or meander the edges of clearing work so it will have natural appearance See discussion pg. 6-59 Timing – May, June, July

Table 6-3 Managing Trails within Chaparral (continued)

Maintenance Area	Typical Conditions -	Conditions to Watch For	Soils Management Recommended Corrective Actions	Vegetation Management Recommended Corrective Actions
Trail Vegetation– Middle Plane (continued)		Heavy fuel loads		When pruning side slopes to manage fuel loads, incorporate mulch of woody shrub materials into leaf litter/duff to minimize future erosion & to promote new growth of woody shrubs See discussion pg. 6-57, 6-59 Timing – May, June July
Vegetation– Overhead Canopy	Overhead Canopy is intermittent	Overhang limbs, leaners & downed Trees See Fig. #6-27		Where trees intrude into trail, prune to provide a clearing 4' wide & 8' high. See discussion pg. 6-62 Timing – All months as needed for hazard abatement and user safety

Table 6-4 Managing Trails within Mixed Woodlands

Existing Conditions & Recommended Corrective Maintenance Actions
(Applies to Chamise Trail, Coyote Trail, Fern Loop, Los Trancos, Panorama Trail, Toyon Trail, Woodrat Trail)

Maintenance Area	Typical Conditions -	Conditions to Watch For	Soils Management Recommended Corrective Actions	Vegetation Management Recommended Corrective Actions
Trail Tread	Clear passage for walking 2.5'-3.5 ' wide Carpet of leaf litter throughout length of trail	Trail Creep – See Fig. #6-3	Remove slough deposits which reduce walkway to less than 2 feet as reduced passage will compromise integrity of trail tread & visitor safety See Fig. #6-4,6-10	Retain leaf litter within trail tread to minimize erosion impacts from rain See Fig. #6-2 Remove vegetation within trail tread – See vegetation/ ground plane below Figs. #6-22, 6-23 Timing – May, June, July
Trail Bed	Median width of trail bed 3.7' Some areas of sloughing within trail bed Large quantities of organic debris in & adjacent to trail bed	Areas where water is collecting & large quantities of organic debris make outsloping impractical	Correct areas of standing water by building up the tread & filling low area with rock. Top with native soil.– See Fig.#6-16 Timing – July, August Where necessary to dissipate water on slopes, add drain dips or water bars See Fig. #6-14, 6-15 Timing – fall, mid-winter, spring	Remove fallen branches that are encroaching on trail tread Timing- All months as needed for hazard abatement and user safety

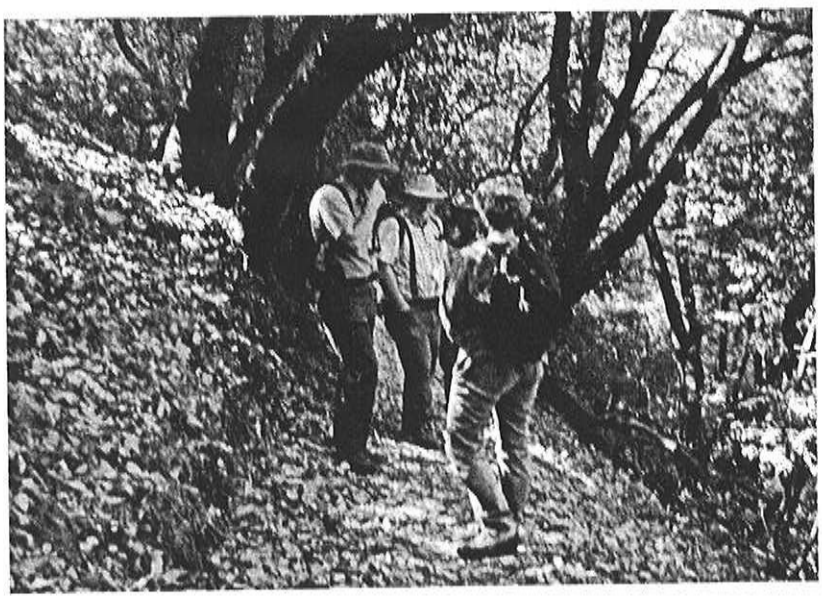
Table 6-4 Managing Trails within Mixed Woodlands (continued)

Maintenance Area	Typical Conditions -	Conditions to Watch For	Soils Management Recommended Corrective Actions	Vegetation Management Recommended Corrective Actions
Trail Corridor/Side Slopes	Side slope terrain is variable Dense vegetation of ground plane and overhead canopy Intermittent heavy vegetation in the middle plane	Sloughing, rilling of upslope over narrowing the trail Failure of downslope See Fig. #6-17, 6-18 Areas that have been overcleared through past management practices– See Fig. #6-22	Periodically remove sloughed materials & where ravel from side slope is compromising visitor safety install a slough containment wall along uphill side of trail See Fig. #6-10 Timing – July, August Repair eroded downslope with retaining & backfill to reconstruct trail bed See Fig. #6-10 Timing July, August	Establish program for revegetating & monitoring side slopes to enhance native plant ecology See discussion pg. 6-37,6-51 Timing – March, October (optimal)
Vegetation–Ground Plane	Dense carpet of groundcovers , ferns, yerba burena dominant	Low plants encroaching into the trail Occurrences of endangered, threatened & sensitive species See Table 4-4 for a listing of known and possible occurrences based on habitat in the trail corridor		Remove plants & loose roots within the *trail tread* See Fig. #6-22 Timing – July, August Conduct pre-maintenance survey & flag sensitive plants See discussion Section 4.4 for appropriate management strategies where nesting birds & mammals are found See Section 4.4 & pg.6-51 for discussion on protecting native vegetation Timing – Conduct surveys Feb.-Oct. prior to initiating trail maintenance & vegetation management activities

Table 6-4 Managing Trails within Mixed Woodlands (continued)

Maintenance Area	Typical Conditions -	Conditions to Watch For	Soils Management Recommended Corrective Actions	Vegetation Management Recommended Corrective Actions
Trail Vegetation– Middle Plane	Middle plane is highly varied & includes a mix of snowberry, toyon, coffeebery & poison oak	Brush that intrudes into passageway – special watch for aggressive natives (e.g. poison oak) that can overtake the trail & diminish visitor's experience Occurrences of endangered, threatened & sensitive species See Table 4-4 for a listing of known and possible occurrences based on habitat in the trail corridor		Where aggressive natives (e.g. poison oak) are overtaking the trail, brush trail corridor to provide clear passage See Discussion pg. 6-61 Timing – Feb. March, May, June, July In other areas work with natural vegetation patterns to "feather" or meander the edges of clearing work so it will have natural appearance See discussion pg. 6-59 Timing – May, June, July Low growing & slow growing shrubs & ground cover on the uphill & lower sides of the *trail corridor* generally should not be disturbed. See discussion Section 4.4 & pg. 6-56, 6-59 Timing – Conduct surveys Feb.-Oct. prior to initiating trail maintenance & vegetation management activities
Vegetation– Overhead Canopy	Overhead Canopy is very dense mix of oaks, madrone, Calif. Bay, big leaf maple	Overhang limbs, leaners & downed Trees See Fig. #6-27		Where trees intrude into trail, prune to provide a clearing 4' wide & 8' high. See Fig. #6-25 See discussion pg. 6-62 Timing – All months as needed for hazard abatement and user safety

Table 6-5 Managing Trails within Bay Woodlands



Existing Conditions & Recommended Corrective Maintenance Actions
(Applies to Los Trancos Trail)

Maintenance Area	Typical Conditions	Conditions to Watch For	Soils Management Recommended Corrective Actions	Vegetation Management Recommended Corrective Actions
Trail Tread	Clear passage for walking 2'-3 ' wide Carpet of leaf litter throughout length of trail	Trail Creep – See Fig. #6-3	Remove slough deposits that reduce walkway to less than 2 ft. to protect integrity of trail tread & promote visitor safety See Fig. #6-4,6-10 Timing – July, August	Retain leaf litter within trail tread to minimize erosion impacts from rain See Fig. #6-2
Trail Bed	Median width of trail bed 3.5' Areas of extensive sloughing within trail	Areas where water is collecting & large quantities of organic debris make outsloping impractical	Correct areas of standing water by building up the tread & filling low area with rock. Top with native soil.– See Fig.#6-16 Timing – July, August Where necessary to dissipate water on slopes, add drain dips/water bars See Fig. #6-14, 6-15 Timing – fall, mid-winter, spring	Remove fallen branches that are encroaching on trail tread Timing- All months as needed for hazard abatement and user safety
Trail Corridor/Side Slopes	Soils are very unstable/side slopes are very steep Large quantities of organic debris make outsloping impractical	Sloughing, rilling of upslope over narrowing the trail Failure of downslope See Fig. #6-17, 6-18	Periodically remove sloughed materials & where ravel from side slope is compromising safety install a slough wall on uphill side of trail See Fig. #6-10 Timing – July, August Repair eroded downslope with retaining walls & backfill to reconstruct trail See Fig. #6-10 Timing July, August	

Table 6-5 Managing Trails within Bay Woodlands (continued)

Maintenance Area	Typical Conditions	Conditions to Watch For	Soils Management Recommended Corrective Actions	Vegetation Management Recommended Corrective Actions
Trail Corridor/Side Slopes (continued)		Occurrences of endangered, threatened & sensitive species See Table 4-4 for a listing of known and possible occurrences based on habitat in the trail corridor and along Los Trancos Creek where the trail parallels the Creek		Conduct pre-maintenance survey & flag sensitive plants See discussion Section 4.4 for appropriate management strategies where nesting birds & mammals are found See Section 4.4 & pg. 6-51 for discussion on protecting native vegetation Timing – Conduct surveys Feb.-Oct. prior to initiating trail maintenance & vegetation management activities
Vegetation–Ground Plane	Ground covers are minimal due to allelopathic soils caused by Bay trees' natural chemistry			Protect existing vegetation on side slopes See discussion Sections 4.4 & 6.4 Transplant native plant seedlings that have become established in sloughed material on trail prior to removing slough. Seedlings should be translated to sites with similar soil types, drainage, light and shade conditions Timing- March, April prior to initiating maintenance work on the trail tread or within the trail corridor
Trail Vegetation–Middle Plane	Middle plane is almost non-existent due to allelopathic soils caused by Bay trees' natural chemistry			Generally Not Applicable
Vegetation–Overhead Canopy	Overhead Canopy is very dense	Leaners, over hanging branches & downed trees–See Fig. #6-27		Cut overhanging limbs & downed trees & remove leaners to provide a clearing 4' wide & 8' high. Fig. #6-25 See discussion pg. 6-62π Timing – All months as needed for hazard abatement and user safety

Timing Maintenance

Scheduling maintenance tasks is key to providing a consistently clean and safe trail system that will be enjoyed by park visitors. The first priority for trail work is to correct truly unsafe situations. The second priority is to correct conditions causing significant trail damage –erosion, sedimentation and off-trail trampling. The third priority is to restore the trail to the planned design standards set forth in this handbook. For a more detailed discussion of the maintenance program and prioritizing work, refer to *Section 5 - The Trail Maintenance Program.*

Table 6-6 Calendar of Trail Maintenance Activities provides a summary of the annual routine maintenance work program for Foothills Park. Weed abatement and pruning activities must not occur without a pre-maintenance biotic survey for potential locations of rare plant or sensitive species, except under the direction of the Open Space Superintendent. Pre-maintenance biotic surveys are intended to identify animal and plants that will need to be protected during construction activities. Where sensitive animal species are found during a pre-maintenance biotic survey, and maintenance work would have the potential to disturb those animals, timing of the maintenance work will need to be revised.

For a more detailed discussion on potential impacts trail maintenance activities and measures to prevent these impacts refer to *Table 4-9 - Potential Environmental Impacts and Measures to Prevent or Reduce Them.* For a listing of species to watch for refer to *Section 4 – Environmental Setting.*

Tracking Maintenance Activities

All trail inspections should be documented in writing in a field log. *Table 6-7 – Sample Maintenance Log* provides a sample maintenance field log for recording maintenance inspections, categorizing needed repairs and identifying completed tasks. Items for consideration in developing a maintenance log include monitoring the integrity of the trail tread, monitoring natural resources (e.g. vegetation within the trail corridor, water quality of adjacent creeks), scheduling work and documenting timing of inspections. The log should provide information on the condition of the trail system including railings, bridges, and trail surfaces, proper and adequate signage. It should also document when repair work has been completed, debris has been removed and trails have been prepared for winter storms and spring/summer use. The maintenance log can also be used to document pre-maintenance biotic surveys and post maintenance evaluations of the trail corridors.

Table 6-6 Calendar of Trail Maintenance Activities

Months	Activities
All Months of the Year as Needed to Maintain Trail Appearance	__Collect litter __Graffiti removal (within 2 days of occurrence)
All Months of the Year as Needed for Hazard Abatement & User Safety	__Monitor unauthorized encroachments __Remove fallen trees, limbs & debris __Repair/replace signs __Conduct inspections & repair facilities (benches, bridges, etc)
January, February, March, October, November, December	__Post "storm damage signs" as needed __Remove "Fire danger signs" at end of fire season __Perform mid-winter water bar, & drain check on trails
February, March	__Assess storm damage including damage to trail structures & erosion damage __Habitat Enhancement – native plant seeding/planting (though usually better success is achieved in October – prior to seeding/planting in this season verify species requirements with a botanist) __Prune Poison Oak back from trail bed (4' min. clear passageway) __Weed Abatement – non-native control*
April, May	__Clean, inspect & repair damage to water dips & water bars __Perform storm damage, & erosion repairs __Remove "storm damage signs" __Inspect/repair/replace steps, bridges, retaining walls damaged during winter storms __Weed abatement & fire hazard reduction*
May, June, July	__Perform storm damage & erosion repairs __Repair washouts & damaged trail tread __Brush & prune trail to provide adequate passage & vertical clearance * __Post "No fireworks" signs (June) __Post and monitor "Fire danger signs" __Remove "No fireworks" signs (July) __Prune Poison Oak from trail bed (4' min. passage)
July, August	__Perform routine maintenance on trail tread
August, September, October	__Monitor "Fire danger signs" __Inspect/repair/replace trail structures (e.g. steps, bridges, slough & retaining walls, benches/informal sitting areas) as needed (mid-Sept- Oct) __Clean, inspect & repair drain dips & water bars to prepare for winter (mid-Sept-mid Oct) __Habitat Enhancement – native plant seeding/planting (Oct)

* Weed abatement and pruning activities must not occur without a pre-maintenance biotic survey for potential locations of rare plant or sensitive species except under the direction of the Open Space Superintendent

Table 6-7 Trail Maintenance Log –Sample

Date _____
Inspectors

_____

Trail Segment

_____

- ❑ Daily/Weekly Inspections
- ❑ Winter Inspection
- ❑ Spring Inspection
- ❑ Summer Inspection
- ❑ Fall Inspection

This list is only to serve as a guide in reporting damaged or missing trail features, safety hazards, accidents, and use violations in an expeditious manner. Look for other conditions. Mark as noted below. Where hazardous conditions are found, close and sign that trail section, report hazard and determine appropriate remedial action (e.g. repair condition, apply for emergency funds to repair condition, close trail segment for season until funds can be allocated in capital budget or volunteer work efforts can be organized). This log can also be used to document pre-maintenance biotic surveys.

Trail Condition

(S) Satisfactory (WN) Work Needed (X) Immediate Attention Needed (WD) Work done (M) Monitor Condition

1. Trail Surface

_____ A. Tread Stability
- _____ Tread free of fallen limbs, trees, debris
- _____ Outside edge firm
- _____ Trail tread width (2' min. clear passage

_____ B. Tread damage from seasonal wash outs

_____C. Treadway Water Drainage
- _____ Evidence of standing water
- _____ Condition of Drainage structures (e.g. water bars, drain dips)

_____D. Surface Erosion Indicators (e.g. water flow patterns, rills, slough material, trail creep)

2. Trail Corridor -Vegetation Maintenance

_____ A. 4' Horizontal passageway
_____ B. 8' Overhead clearance

3. Vegetation Enhancement

_____ A. Replacement trees/shrubs
_____ B. Staking cages
_____ C. Weed abatement

4. Trail Structures

_____ A. Bridges
- _____ Bridge #
- _____ Decking
- _____ Beams/Stringer
- _____ Abutments
- _____ Railings

_____ B. Steps
- _____ Risers
- _____ Tread

_____C. Walls
- _____ Retaining
- _____ Slough Containment

_____ D. Benches

5. Review of Previous Trail Management Practices

_____ A Previous Deficiencies - Outstanding
_____ B. Previous Deficiencies - Have been repaired

6. Visitor Interface

_____ A. Education/Outreach
_____ B. Accident assistance
_____ C. Citation Issued

Pre-maintenance Biotic Survey

__ Survey conducted __ Endangered Species present __ Sensitive Species present
__ Individual plants flagged __ Area temporarily fenced
__ Work crew advised of construction sensitivities

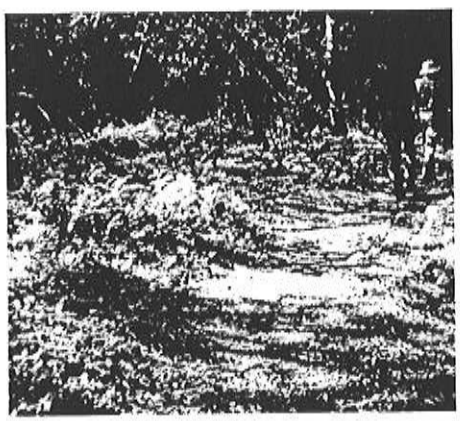
Table 6-7 Trail Maintenance Log –Sample (continued)
Items Requiring Attention

Condition or Problem	Recommendations to Correct Problem	Estimated Cost	Date-Initials

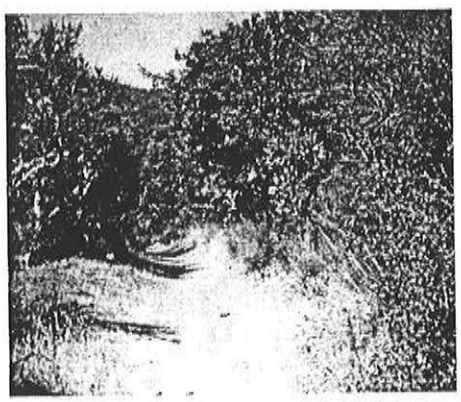
Description of How and When Problem Was Corrected **date** _____
initials _____

6.6 The Trail Surface - Correcting the Tread - Width & Surface, Grading & Drainage

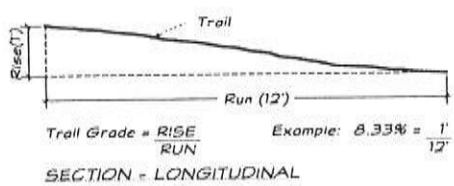
When making decisions on actions to take to repair the trail surface, strive to find a balance between keeping the trail surface serviceable and reasonably safe, and providing the least disturbance to the natural setting. Where recommendations suggest filling or excavating the trail tread, materials should be redistributed within the trail bed wherever, possible. Where this is not possible, it will be necessary to bring in or carry out materials. The adjoining side slopes should not be altered for this purpose as it will disturb vegetation on the side sloes that is providing a natural "erosion control mat" and creating the visual character that visitors expect when they travel these trails. A key to the recommendations for maintaining the trail surface is provided below.



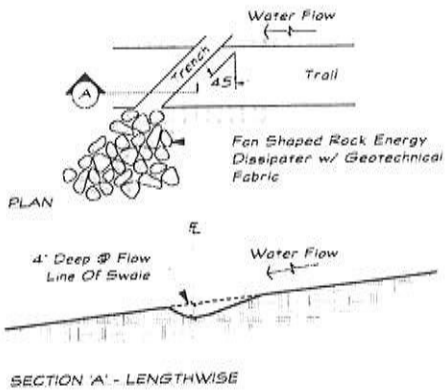
Typical Conditions Requiring Maintenance of the Trail Surface



Repairing the Trail Surface



Typical Conditions Requiring Maintenance of the Trail Surface Drainage



Maintaining Positive Drainage

Trail Maintenance – Trail Surface

Defining Surface Maintenance

Trail surface maintenance tasks are those tasks related to restoring the *trail bed* to provide a firm walking surface relatively free from obstacles or hazards with adequate drainage to prevent standing water on the trail and to prevent excessive flows and erosion down the trail.

Developing a Program with the User in Mind

Trail surface maintenance work must be balanced between keeping the trail surface serviceable to the level expected by the trail user and providing the least disturbance to the natural setting.

Generally, people who typically hike 1-3 miles will tend to be less experienced (e.g. families with children) or have more mobility constraints (e.g. walk with a cane, need more frequent rest stops or need assistance traversing steps or potentially slippery surface). These hikers will have a higher expectation to see handrails on steps and guardrails on bridges, and will be more dependent on these assistive devices being in good repair for their personal safety.

On the other hand, hikers who are generally more experienced and skilled expect fewer modifications to the natural environment to accommodate their personal comfort.

Therefore, the areas most closely aligned with Los Trampas and Wildhorse Valley (the main meadow areas) should be slightly more developed and should receive the most frequent and thorough inspections to ensure the highest degree of safety and accessibility for the widest range of users.

Trails with access from Los Trampas Valley that provide a 1-3 mile loop include:

- Los Trancos Trail – Steep Hollow Trail Loop
- Los Trancos Trail – Sunrise Trail - Steep Hollow Trail Loop
- Los Trancos Trail – Chamise Trail - (Not a Loop)
- Los Trancos Trail – Chamise - Fern Loop Trail
- Fern Loop Trail

Refer to *Map 2-2 Foothills Park Trails System* for the location of these trails.

The Trail Surface Maintenance Program

Routine trail repair work to the trail surface tread will be required to achieve the program objectives described above will involve trail projects to:

- Minimize tripping hazards (e.g. fill ruts and holes in the tread, cut loose, exposed tree roots, removing loose rocks, make approaches to bridges flush with trail tread and replace fill on steps). Balance excavation/fill within the tread with the protection of roots, plants, and rocks that they are serving as natural water bars, anchoring the trail bed and stabilizing soils.

- Restore sections of trail bed damaged by slides and washouts
- Install/repair rock walls or cribbing that are supporting trail bed
- Collect and dispose of discarded litter

Figure 6-2
The Optimum Trail Surface

The Optimum Trail Surface

The optimum tread will be compacted native earth and may have a light cover of native leaf litter. The native understory vegetation will touch onto the trail in a feathered patterned that will show little to no evidence of recent maintenance activities. The trail will be able to divert water by outsloping drainage dips or water bars. Soil berms along the outside edge will be minimal to non-existent. The trail alignment will follow a gently undulating grade to enhance drainage and eliminate monotonous level stretches and long, steep grades that are tiring to trail users. This type of trail surface will also minimize the number of structures (e.g. bridges, steps, water bars) that must be built to maintain a stable *trail tread* or walking surface 2 to 4 feet wide.

Typical Tread Conditions Requiring Maintenance Actions

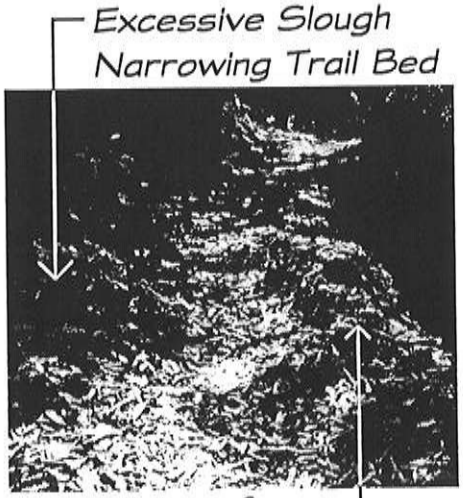


Figure 6-3
Trail Creep/Over Narrow Trail

Tread Condition - Trail Creep/Over Narrow Trail

Trail creep is the condition created when the trail surface has been eroded and displaced slightly downhill by travel along the outside edge. It is caused by people walking on the outside edge of sidehill trails where the tread has been narrowed by sloughing of the uphill slope. This sloughed material (loose soil, rock and debris) moves off the upper sidehill to the inside of the tread narrowing the overall tread width. This forcers hikers toward the outside edge. This condition can also be created when the original trail is constructed too narrow or with cut slopes that are too steep.

Whether caused by excessive sloughing onto the trail tread, or by trail construction that has resulted in too narrow a trail, the resulting trail creep can result in a breakdown of the outside edge of the trail. This can lead to deterioration of the trail bed.

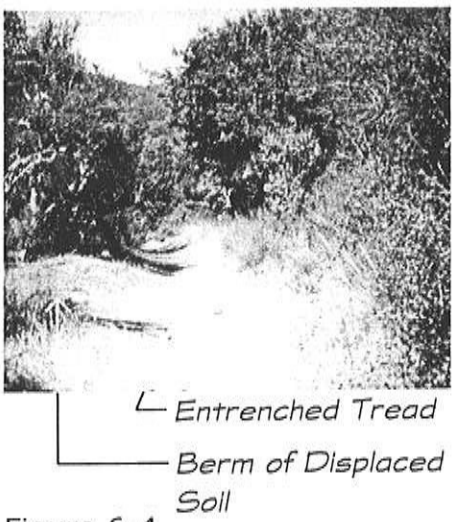


Figure 6-4
Entrenched Trail Beds & Berms

Tread Condition - Entrenched Trail Beds & Berms

Heavily used trails will often develop a narrow trench in the center of the trail. The entrenched trail collects and concentrates runoff water. This water is forced to run down the tread itself, gathering volume and soil as it goes. This condition is a natural consequence of tread surface erosion and redeposition, and of inadequate compaction during construction. The resulting berms will form a barrier that prevents water from running off the trail and can lead to severe erosion of the trail bed. Unless corrected, this condition can become more pronounced by the channeling of water until the water can find a weak area along the outer edge of the trail. At this point the water will spill off the trail taking loose soil with it.

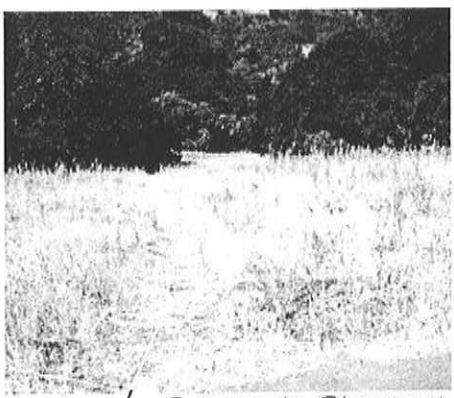


Figure 6-5
Shortcutting

Tread Condition - Shortcutting

It is human nature to take the easiest and shortest path between two points. If there are no natural barriers in the way and people can see the trail above or below them, then people will tend to take shortcuts. The problems resulting from switchback shortcutting include serious soil erosion, vegetation loss, safety hazards, and visually unattractive trails.

Figure 6-6
Overwide Trail

Tread Condition - Overwide Trail

In some areas the trail was either constructed wider than 4 feet or the vegetation has been brushed back beyond the original edge of the trail bed. An overwide trail area that is not being traveled upon on can create opportunities for invasive, non-native plants to increase in extent.

Tread Condition - Overuse

Use of compacted native soil is best for foot traffic on trails that do not receive heavy use. In Foothills Park the overall use of the 1,400 - acre park is limited to 1,000 visitors at any one time. The majority of these users will be congregated in the meadow/picnic area and Boronda Lake. Typically the volume of trail use, which will be dispersed over a 15-mile trail network of hiking trails will not result in overuse. However, special attention should be given to the first 1 to 3 mile segments of trails that begin near areas where people can park or congregate. This is generally the area that can be expected to show the highest signs of use. Refer to *Map 2-2 Foothills Park Trails System* to identify trails that begin from Las Trampas and Wildhorse Valleys, the main meadow/ picnic & camping areas.

Heavily used trails will exhibit a loss of leaf litter and organic material, leading to the creation of a dusty or hard-packed soil.

Overused trails may also exhibit over compaction, entrenchment, and widened or multiple trail tread. Such trails are more susceptible to erosion damage.

Repairing the Trail Surface

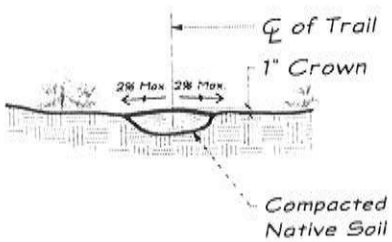


Figure 6-7
Filling Ruts

When Trails Become Overused

Generally, an earthen trail will require ongoing maintenance to avoid erosion problems. In areas that receive the highest use, rangers should watch for signs of over compaction that could destroy the natural structure of the trail bed making the area much more susceptible to erosion damage.

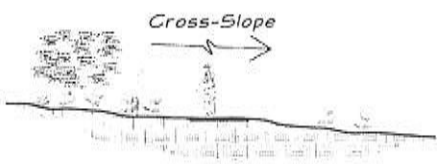
Where a trail is showing signs of overuse, adding and/or retaining a variety of organic and inorganic materials may strengthen native soil surfaces. In some areas, it may also be helpful to provide some kind of edging in order to contain the materials and maintain the integrity of the trail bed. In flat areas (such as the trail shown in this diagram), the trail should be restored to provide a crowned trail. In hillside areas, the trail bed should be

restored to provide an outslope (Refer to *Figure 6-8 Outsloping the Outside Edge of a Trail* for an illustration).

Inorganic materials - Inorganic materials may include mineral aggregates, such as different types of sand and gravel where soils are wet. These materials must be well-compacted, and free of large-sized or rounded aggregates that will not compact into a firm surface. Crushed stone, such as granite or limestone chips provide an excellent surface, as do the materials generally used to construct a road sub-base. These materials readily compact and interlock to create a comfortable walking surface.

Trash Removal/Vandalism Repair

Routinely removing litter and monitoring trail structures for signs of vandalism within the trail corridors is important from both a safety and aesthetic viewpoint. Litter and graffiti control, more than any other single activity, will give the public an immediate positive or negative impression of the park. Trash removal and vandalism monitoring should take place on a regularly scheduled basis occurring at least weekly. The actual frequency will depend on the level of trail use and the location of the trail.



SECTION / ELEVATION
Figure 6-8
Outsloping

Trail Tread Remedies - Outsloping the Outside Edge of a Trail

Definition/function - Outsloping the trail can be the quickest and most immediate form of drainage control. An outsloped *trail bed* is one that is lower on the outside or downhill of the trail than it is on the inside or bankside. Outsloping the trail will allow water to sheet flow along its natural course across the trail and down the slope. This trail design is most effective if the trail gradient is gradual, the surface is durable and not slick, the back slope stable, the trail traffic is light, and there is little to no vegetation on the outside shoulder. Where these conditions are not prevalent, outsloping a trail may not always be feasible, and even when it is feasible, it may need to be supplemented with other techniques.

Maintenance Technique - To outslope the trail bed, smooth the trail tread to remove minor ridges, or rills that can cause the water to stand or flow along the trail length.

Remove berm and sloughed material and obstructions (such as large rocks, and stumps) which are preventing water from leaving the trail surface.

Modify the trail tread by developing a downward slope toward the outside of the trail between 2% and 4% (as measured by a clinometer), at a minimum, to cause water to runoff the trail tread by sheet flow.

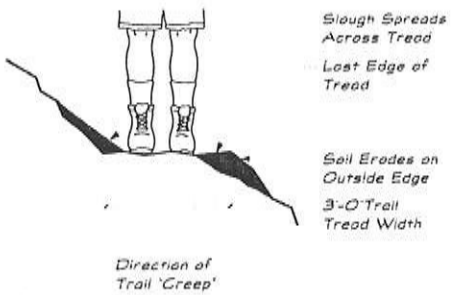


Figure 6-9
Tread Creep

Trail Tread Remedies - Correcting Tread Creep, Entrenched Trails and Berms

Definition/function – To improve visitor safety and the integrity of the trail tread, the material from the uphill slopes of a trail that has sloughed or eroded onto the trail bed causing the tread to become overly narrow should be removed.

Maintenance Technique - Excess material from the uphill slopes should be removed and spread over the width of the trail to produce the intended drainage flow. The deposits of soil berm found on the outside edge of the trail should also be removed and spread over the width of the trail.

Once the trail bed has been redefined to provide adequate width for walking, drain and fill low spots in the trail tread capable of holding surface water with mineral soils and/or rock not exceeding 2 inches in diameter.

Fill and resurface ruts and holes, gullies and other damage to the tread occurring through normal use exposure. Place temporary water bars across repaired trail until fill is thoroughly compacted through use and run-off pattern has been established directing water off trail.

Where an incision is evident on a slope within the trail bed, fill the incision and construct drain dips or water bars every 50 feet at the end of the dry season to dissipate water and prevent further entrenchment. (refer to *Figure 6-3-Entrenched Trail Beds & Berms* for an example of an incised trail. Refer to *Figure 6-14-Drain Dips and Figure 6-14 Water Bars* for illustrative examples of these drainage techniques).

Where incision occurs in a flat area, regrade the trail tread in a crown formation to facilitate draining water off the trail. When correcting an entrenched trail in a flat area, water must also be diverted every 50'-100' upslope with water bars or drain dips to dissipate the volume of water before it reaches the flat area.

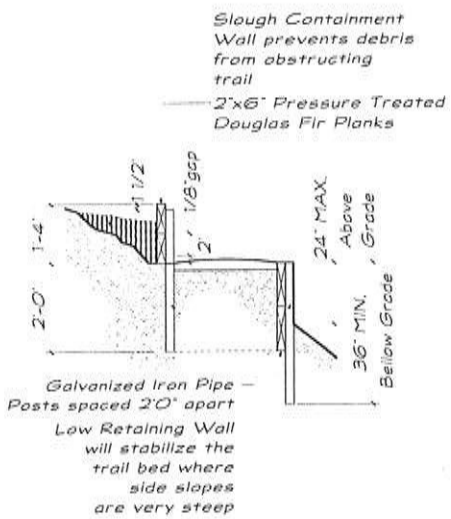


Figure 6-10
Slough Material Containment Wall
Low Retaining Wall

Trail Tread Remedies – Sloughed Material Containment Wall/Low Retaining Wall

Definition/function – In some areas sloughed materials from the upslope are over narrowing the trail. In some areas (e.g the bay woodlands where there is little under-story vegetation and extensive dry ravel) periodic re-moval of sloughed material deposits is not adequate to maintain a trail tread width of 2 feet to 4 feet. In these areas it may be necessary to construct a "wooden slough wall" at the toe of the up slope to contain this loose material in order to provide safe passage for park visitors.

Maintenance Technique – Slough containment walls can be used effectively at the toe of an uphill bank where alluvial fans of dry ravel are visible from the trail and are directly impacting the trail bed. The slough containment wall should be approximately 1 to 2 feet high and should be placed approximately 10 inches or a shovels's width from the toe of the uphill slope. The length of the wall will vary depending on existing site conditions, but generally will not need to exceed 5 feet to 6 feet in length. The ends of the wall should be left open so that field staff can periodically clean out the excess materials from behind the wall.

In some cases, where the side slopes are very steep, a low retaining wall may also need to be constructed on the downhill side of the slope to help stabilized the trail tread and to ensure that there is adequate width for hikers to travel. The top of the wall should be flush with the top of the trail. The wall maybe constructed of rock, or pressure-treated wood or "trex", as appropriate to the surrounding environment. If wood or "trex" planks are used for the wall, 1 1/2"diameter (minimum) galvanized iron pipe post should be used to secure the planks against the bank. These posts need to be driven deep into solid ground (a minimum of 36" into stable native soil or 1 1/2 times height of wall whichever is greater). The trail bed should be compacted to 90%-95% against the wall. As

an additional trail structure, these walls will require routine inspection and repair. Additionally, they may detract from the natural character of the trail corridor. Therefore, these walls should only be used adjacent to the steepest sidehills in the areas as a means of last resort to prevent over narrowing of the trail tread from hillside erosion. The most susceptible sites of erosion include steep hillsides in the bay woodlands and areas with visible debris flow scars.

Trail Tread Remedies - Narrowing Overwide Trails

Definition/function – In some locations trails are over 5 feet wide. In some cases the trail may have actually been constructed to this width, in other cases, past maintenance practices have resulted in an increase in the overall trail width. Where trails have been widened excessively, the "trail shoulder" may exhibit a barren earthen scar, which is not visually pleasing to the eye. This excessive shoulder, if disturbed, may result in a weed encroachment problem. Therefore, it is often best to develop a maintenance strategy that allows for natural growth to encroach into the trail until the desired trail width is achieved. See discussion *Section 4 - 5 Noxious Plants.* Where it is determined that action is required to narrow the trail the following recommendations should be followed.

Maintenance Technique - Narrow trail to the standard width of 3-4 feet by pulling in part of the "sidecast" if the trail is cut into a side slope. Pull this material up to and against the toe of the backslope and compact. Where plants are present, they should first be removed with their root ball intact and replanted into the remaining side slope.

In open flat areas, narrow trail to the standard width of 3-4 feet by scarifying the excess width to break up the compacted soils and allow new vegetation to grow. Reestablish vegetation with native species appropriate to the specific site. Refer to *Section 6.4 - Habitat Enhancement & Protection within the Trail Corridor* for a discussion on revegetating the trail edge and *Section 6.4 - Vegetation Management Ground Plane - Controlling Non-Native Plants* for a discussion on controlling non-native exotics in these newly disturbed areas.

In some instances, it may be necessary to block the extra trail width with natural debris such as downed logs, limbs, brush and rock to discourage further use. Place material in a scattered or irregular pattern so it does not look artificial. Partially bury rocks and logs with weathered side placed up.

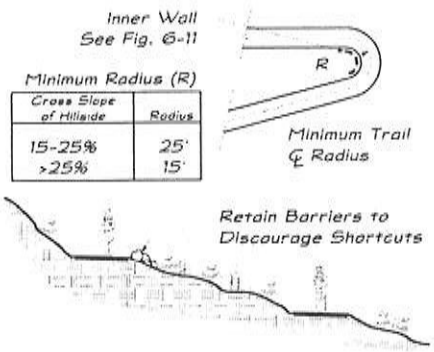


Figure 6-11
Switchbacks

Trail Tread Remedies - Improving Switchbacks to Discourage Shortcutting

Definition/function – Switchback cutting will result in the deterioration of the trail and the vegetation of the associated trail corridor, which can cause erosion of the side slopes. Therefore, switchbacks must be constructed and maintained so as to prohibit or at least discourage, switchback cutting.

Construction Technique - Switchback turns should be spaced to provide long, gradual climbs and allow a broad, nearly level area to turn. Maintain the trail width and minimum grade throughout the corner. Turns should be looped around large boulders or fallen trees, or where vegetation obstructs the view of the adjoining leg. Avoid the common corner situation where either the landing itself or the first piece of trail up from the landing is too steep. In this case the trail, the corner and inner wall, will need to be extended and the switchback lengthened to reduce the required grade.

Maintenance Technique - Maintaining climbing turns or switchbacks requires working on the tread, repairing drainage, and doing any necessary work on retaining walls, guide structures and barricades.

Collapse or erosion of the inner wall is most commonly caused by switchback cutting, so this corner should be reconstructed to discourage this activity. Methods for doing this include, where a wall has been constructed, making the wall steeper, or laying a tier of rough, jagged rock.

Switchback legs should be situated so that they are not visible from each other. If this is not possible, rock or log barriers should be placed between the upper and lower legs of the switchback.

The tread should be graded to promote positive drainage. Sloughed materials should be removed to return the trail to its original width, and tread obstacles should be removed. Retain barriers, such as rocks, plant materials or fences along the edge of the trail to discourage short-cuts between switchback levels.

Where shortcuts have become established the "renegade route" should be closed and restored once the switchback has been improved to prevent erosion of the side slopes and damage to the vegetation.

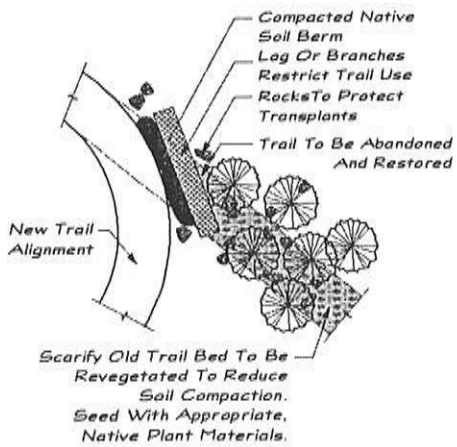


Figure 6-12
Closing & Restoring
Renegade Trails

Closing & Restoring "Renegade Trails"

Definition/function – "Renegade Trails" can damage the native vegetation of the associated trail corridor, which could cause harm to endangered and sensitive biotic species, and potentially could result in an increase the extent of a weed problem.

Maintenance Technique - Typically the work required to close a "renegade trail route" will include the following procedures:

Grade the trail bed and adjacent area to return the surface to its original shape and contour. Divert water off the renegade trail area with water bars. Fill in ruts and gullies with local soils and gravel.

Grade the trail bed and adjacent area to return the surface to its original shape and contour.

Scarify the volunteer trail to break up the compacted soils and allow new vegetation to grow. Use rocks, erosion cloth, net or other biodegradable covering agents (e.g. erosion control mats typically contain a layer of rice straw or excelsior sandwiched between photo-degradable netting stakes) to impede the speed of water and inhibit gullying and rilling, where required to stabilize the slope. This material should then be laid and secured, as directed by an erosion control specialist.

Reestablish vegetation with native species appropriate to the specific site.

Block area from further use and install signs stating "Area Closed: Habitat Restoration" at trail junctions leading into the restoration area. In some cases, it may also be prudent to construct some type of temporary fencing to prevent access.

Trail Maintenance – Drainage

Grading and Drainage Defined

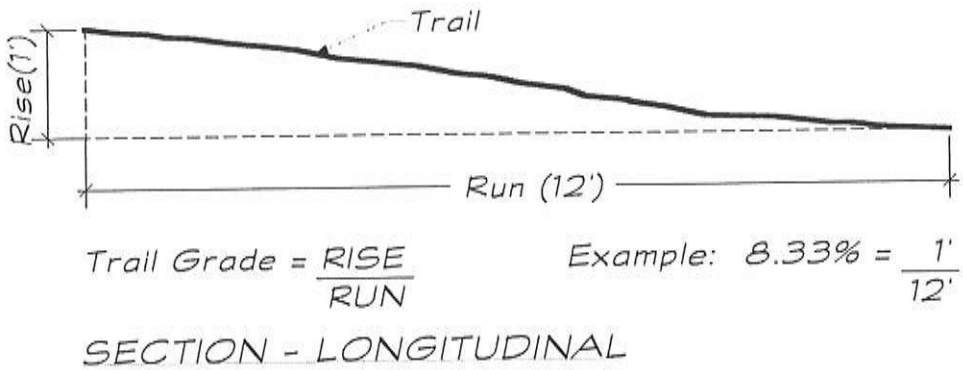


Figure 6-13 Illustrating Trail Grade Rise/Run

Trail grade is the slope maintained by the trail in the direction of travel. It is measured in percentage (feet of change in elevation for every 100 horizontal feet). In determining the upper limit of the grade, the nature of the trail surface and the texture of the soil should be considered, as this will determine the slickness of the trail when wet. Refer to *Section 4-7 Geology & Soils* of this handbook for a more detailed discussion on soils and slopes.

Drainage refers to the control of the flow of water either across, under, through, or around the trail. In dealing with drainage it is important to understand the characteristics of water flow:

- Water flows downhill along the steepest and fastest route available.
- The faster water flows, the more cutting force it develops.
- The greater the volumes of flowing water, the greater cutting force it develops.
- Rapidly flowing water resists changing direction.
- The slower the water flows, the greater the possibility for water to percolate into the soil.

Typical Drainage Problems

Problems associated with the unchecked flow of water can occur when the trail interrupts the natural drainage process. Improper drainage design can result in problems of two kinds: flowing water and standing water. The trails on hillsides can intercept sheet flow or channel flow and concentrate it to flow along the trail

surface leading to rill or gully erosion and increasing the risk of debris flows occurring where the water finally exits the trail. Trails in flat, low lying areas can become saturated resulting in wet, slippery, muddy conditions.

Maintaining Positive Drainage

In general, the way to minimize water damage is with a trail design that sheds water frequnetly, without permitting a build-up of velocity or volume. Appropriate drainage maintenance techniques will accommodate the "natural" flow of water on and off the trail.

To accomplish this, the trail drainage maintenance program should include the following work to maintain positive drainage:

- Rework outslopes and compact the trail tread to promote sheet run off. Large scale grading is generally unacceptable.
- Contour cuts to blend with the natural slopes. Sidecast slopes should be lightly compacted and covered with a thin layer of duff.
- Remove sloughed materials from the trail tread and either, haul it to a flat stable area where it can be spread and compacted into the trail tread, or redistribute the material on the downhill slope. (Soil must not be placed on the downhill slope of a trail where it could enter a creek or stream and, impact adversly water quality.
- Repair slumps, fill erosion ditches, grub rocks/roots/stumps from the trail tread.
- Routinely inspect and clean/repair/replace/add drainage facilities such as water bars and water dips to prevent loss of trail tread from erosion.

Where outsloping is not possible, or will not adequately provide for positive drainage, such as steeper segments of the trail, other techniques may need to be employed. These drainage options are describe below.

Tools for Improving Drainage

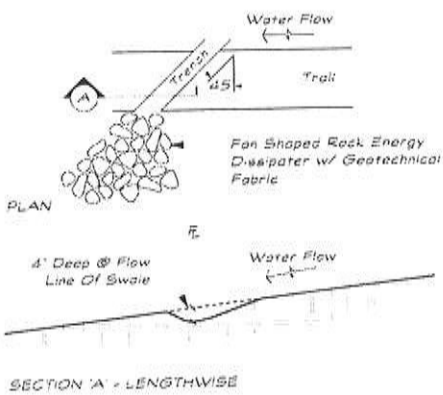


Figure 6-14
Drain Dips

Tools for Improving Drainage - Drain Drips or Drainage Swales

Definition/function – Drain dips are sections of trail where a short piece of the trail, generally 5 to 15 feet is built with a grade slightly adverse to the prevailing grade of the trail. Grade dips are cost –effective in controlling erosion and are more maintenance-free than water bars.

Construction Technique - Locate the drain dips where natural swales or drainages bisect the trail and where the slope of the trail tread is less than 10%. Place the drain

dip across the trail to direct the water to the downhill side of the slope. The dip should be built at a 45 degree angle from a line perpendicular to the trail direction.

Design the drain drip to reverse the grade of the trail for 10-20 feet, beginning on the up trail side with a normal outslope. Gradually increase the outslope as the trail grade is cut and lowered to create the trough and drain point. The dip should slope to the outside edge of the trail at 15% minimum (8" drop for a 4' foot wide trail).

Accompany the dip with an outslope that diverts the water off the trail tread. Provide a ditch or drainage channel below the drain point, to allow water to escape from the trail and fill slope without creating undue erosion. This channel may also require armoring with native rock to reduce scouring and bank erosion.

Maintenance Technique - Monitor the effectiveness of the drain dips as they breakdown over time and must be rebuilt. In some cases the upper portion of a grade dip may be too steep for proper maintenance (e.g. where the gradient exceeds 15%). An alternative method in this case is to build water bars.

Tools for Improving Drainage - Water Bars

Definition/Function - Water bars keep the speed, volume and distance water travels down the trail to a minimum. The greater the slope of the trail and the more water that is channeled by the trail, the greater the need for water bars. They should be placed below points where a significant amount of water enters the trail.

Construction Technique- Create a shallow ditch that crosses the trail to direct water to the downhill side of the trail on running slopes greater than 10% where slopes are too steep for drain dip. Use excavated material to build a berm on the downhill side of the ditch. On the uphill side of the water bar the tread should be graded several feet down into the trench. The trench should be deep enough to contain about 1/2 of the diameter of a log water bar or 2/3 of the height of rocks used for the rock water bar. All excavated soil and rock should be placed on the downside of the bar and packed so the tread is flush with the top of the water bar.

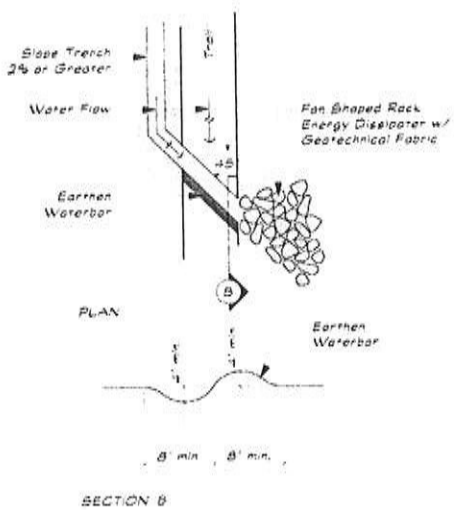


Figure 6-15
Water Bars

Angle the water bar between 30° and 60° to the run of the trail section. The water bar should be a minimum of 4 inches above the level of the ground on the uphill side and should extend 12 inches into the side of the hill and 6 inches beyond the side of the trail on the downhill side. Build the water bars so that they emphasize the natural drainage pattern.

Maintenance Technique – Proper water bar maintenance is essential to the long-term function of the drainage system. These drains should be cleaned thoroughly in the spring to accommodate an entire season of trail traffic (which will kick debris and soil into the drainage and breakdown the berm portion).

Do not allow debris to dam up off the trail. The width of the drain leading off-trail should be at least two shovel blades wide,(approximately 12 to 18 inches) if possible, within the limitations of rocks or other obstacles. Monitor the effectiveness of the water bar as they breakdown over the rainy season and generally must be cleaned out or rebuilt every fall.

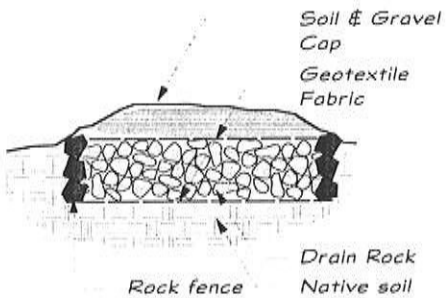


Figure 6-16
Rock Drain

Tools Improving Drainage - Correcting Wet Soils

Definition/Function - A rock drain is an elevated section of trail, that usually is constructed across permanently or seasonally wet areas. Rock drains protect trail surfaces from erosion in low spots where water tends to collect and saturate the soil. In these situations, this solution can be used effectively to reduce the potential of slope failure and to improve year-round accessibility.

Construction Technique- A rock drain should be built to be as inconspicuous as possible. This means it must be built to the minimum height and width needed to bridge the problem area. Generally the outer edge is larger rock, but logs may also be used. Lay the rock with a good outside face to present an aesthetic appearance and to present a near level surface that can be walked upon. Once the walls are laid and chinked, begin to build up the tread by bringing rock and breaking it up to fill size (maximum diameter 3 to 4 inches). Fill the causeway with rock within 4 inches of the top of the rock edges or logs. Once the rock has been placed, install a layer of geotextile fabric over the drain rock. Fill the remainder

Fill the remainder with plenty of native soil; be sure to secure and completely cover the geotextile fabric. If exposed, this material can cause a tripping hazard as well as become unsightly. It is also important to crown the soil to allow for compaction especially in the center. Ramp the approaches to avoid an unacceptable "jump up".

6.7 Infrequent Conditions on Hiking Trails that Require Special Management

Routine inspections will help identify public safety and resource management concerns, as well as routine maintenance needs associated with potential slope failures. This process involves hiking each trail and monitoring the general condition of the trail bed and tread surface in areas known to have experienced slope failures in the past, or exhibiting conditions described below that could be expected to result in a slope failure as a result of a debris flow or a landslide. Areas of highest concern will be those sections of trail that have the potential to be the most hazardous to the public by making the trail surface unstable or even impassable. These areas should be routinely recorded in the Maintenance Log so changes will be documented over time and appropriate corrective actions can be anticipated, budgeted and scheduled. A key to the recommendations for monitoring debris flows and landslides is provided below.

Slope Failures

Slope Failures

Debris flows, commonly referred to as "mudslides", are the most frequent type of landslide in Foothills Park and throughout the Santa Cruz Mountains. The park's trail system, includes trail damage caused by both debris flows and deep-seated landslides.

Trail Maintenance – Debris Flow Scars

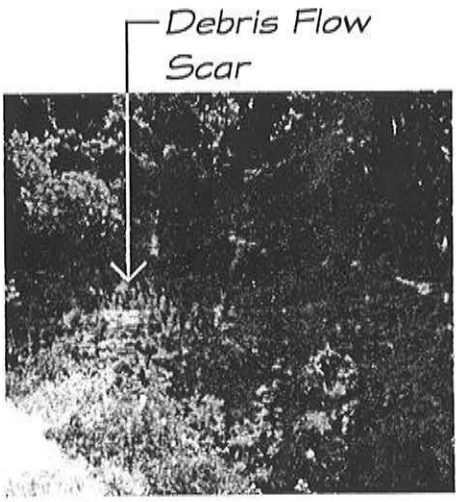


Figure 6-17
Debris Flow Scars

Description - Trails that pass over debris flow scars will have unique maintenance requirements. A good example of a major debris flow scar crossed by a trail is on the Los Trancos Trail approximately 0.5 mile from the junction with Trappers Trail.

This slide occurred during a major storm in the winter of 1998 and was rebuilt the following spring by the California Conservation Corps (CCC). The trail passes through the debris flow scar and the trail bed seems to have been temporarily stabilized by this CCC work effort. The soils within the trail corridor are loose and unconsolidated. The side slopes on both sides of the trail are very steep. On the uphill side of the trail the loose soil continues to slough onto the trail bed, narrowing the trail tread to as little as 12 – 18 inches in some places. The downhill side of the trail has a severe drop-off. Although there is an ephemeral creek immediately north of the slide area with good flow during storms, rangers have indicated that the trail is well drained with no ponding of runoff water. Immediately south of the slide zone is a unique habitat zone of native red flower thistle.

Short-term Recommendation - Maintain the trail in such a manner as to prevent water from collecting or ponding in the slide zone. Avoid cutting any further into the hillside to widen the trail bed. A two-foot high slough wall could be used in some spots to catch sloughed material and prevent trail narrowing. It would need occasional maintenance to remove sloughed material caught behind the wall. Due to the nearly vertical side slopes and the narrow width of the existing trail tread in this area, a low retaining wall should also be constructed on the downhill side of the slope paralleling the location of the slough walls on the uphill slope. The construction of these two trail structures will help to stabilize the trail tread and ensure that there is adequate width for hikers to travel.

Long-term Recommendation - Monitor trail conditions after high-intensity rainstorms to see if additional slope movement has occurred.

Consider installing an interpretive sign about debris flows at the trailhead. The sign could both inform hikers of the potential hazard and explain debris flow processes and their role in shaping the local geography. It could also discourage use of trails exhibiting this condition during the rainy season.

Trail Maintenance – Bridge Crossings in Debris Flow Run-out Tracks

Description - Los Trancos Trail Bridge #3 and Fern Loop Trail Bridge #2 are in the path of seasonal debris flows that become active during heavy winter storms. A debris flow washed out Fern Loop Trail Bridge #2 in 1998. This bridge has been replaced. A debris flow also washed out Los Trancos Bridge #14. This bridge needs to be replaced. Rangers currently have a watch on Los Trancos Trail Bridge #3 for future repair/replacement as they anticipate another major storm may destroy this bridge.

Short-term Recommendation- Investigate the debris flow source areas to see if water control measures could be implemented to divert storm runoff away from unstable slopes.

Long-term Recommendation - Consider installing an interpretive sign about debris flows at the trailhead. The sign could both inform hikers of the potential hazard and explain debris flow processes and their role in shaping the local geography.

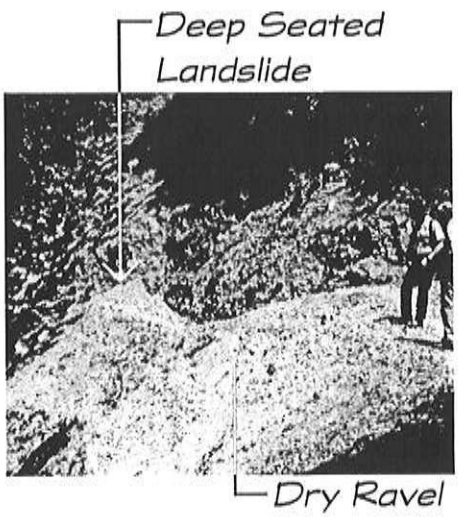


Figure 6-18
Deep Seated Landslides

Trail Maintenance – Deep-seated Landslides

Description - The best example of a trail that crosses a deep-seated landslide is the Los Trancos Trail at the southern edge of the park. The trail crosses the Los Trancos Creek Landslide, which is a deep-seated landslide that extends into Los Trancos Creek. It is a very active area that will continue to be unstable year round because it is an extremely steep slope (steepness exceeds a 100% graduated slope) that is being undermined each year by stream flow. In September of 2001 tension cracks were visible on the slide scar below the trail and

dry ravel was actively transporting sediment into the streambed. Since the slide face exceeds the normal angle of repose, additional slope movement could occur at any time.

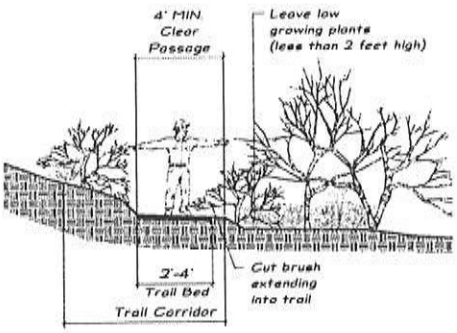
This situation will continue to jeopardize the trail bed and create a hazardous situation for trail users, which is a high liability for the City. Continued efforts to dig out the trail are not addressing the underlying instability and may be aggravating water quality impacts to the stream below. This well meaning trail work could put the City in a state of non-compliance with the California Department of Fish and Game and the Regional Water Quality Control Board.

Short-term Recommendation - As an immediate action, the trail should be signed as closed and blocked off where it begins to parallel the creek well before it crosses the slide scar. The northern closure should be just south of Los Trancos Trail Bridge #12. A bench should be incorporated into the flat area which provides a natural destination point for a picnic/rest stop along the creek. The southernly closure should be located between Los Trancos Trail Bridges #10 and #11. The City has already placed a memorial bench at this location and terrain provides for a natural visual "end-point" here.

Long-term Recommendation - As a long-term solution the City should review a variety of options with a registered geotechnical engineer. A separate environmental analysis should also be prepared as these options are pursued. These options could include: 1) an evaluation of the site to determine if there are any remedial measures that could be undertaken to stabilize the trail bed, 2) an evaluation of sites where a destination overlook could be developed to provide a scenic view and create a physical barrier to prevent further access into the area, and 3) an evaluation of remedial actions that might be undertaken to reduce future, potentially adverse water quality impacts to Los Trancos Creek. If the long term recommendation of the geotechnical engineer is to keep the trail closed within the area of the deep-sealed landslide, then the guidelines for trail closure under *Section 6-4; Subsection-Naturalizing Abandonded Trails* should be followed as accepted or modified by the geotechnical engineer and the environmental consultant.

6.8 Typical Vegetation Conditions & Recommendations for Managing Vegetation within the Trail Corridor

All vegetation management actions have the potential to change conditions within the trail corridor. Removal of a perceived weed or overgrowth of native vegetation may result in a different weed problem, resulting in unintended, undesirable consequences. Therefore, vegetation management activities should be limited to what is necessary to keep the footpath open and reduce hazardous conditions. Routine actions should be directed towards providing adequate vertical and horizontal clearance for safe passage, while providing hikers with a visually pleasing experience. A key to the recommendations for managing vegetation with the trail corridor is provided below.



Vegetation Management Defined

In this handbook vegetation management refers to the manipulation (e.g. removal, control and in some cases, the promotion of) plant species or habitat within the *trail corridor* for the purpose of providing a clear passageway along the *trail tread.*

The Vegetation Management Program

Vegetation Management Practices

All vegetation management actions have the potential to change conditions within the trail corridor. Removal of a perceived weed or overgrowth of native vegetation may result in a different weed problem, even within one growing season. In short, vegetation management may affect plant and animal habitats, in some cases improving them, in others having unintended, undesirable consequences.

Therefore, vegetation management activities should be limited to what is necessary to keep the footpath open and reduce hazardous conditions. Routine actions should be directed towards providing adequate vertical and horizontal clearance for safe passage along the trail treadway, while providing hikers with a visually pleasing experience of Foothills Park's natural ecology.

Such routine actions include activities to control non-native invasive plant species, particularly, when they are threatening an endangered or threatened species or a scenic or sensitive resource. In these cases, vegetation removal techniques with higher selectivity, aimed at cutting or removing specific plants or plant species and limiting damage to other plants are favored. Such techniques will tend to disturb the land less, and provide fewer opportunities for annual weeds to establish. However, these techniques also tend to be slower, more costly, and in large areas may not remove enough plant material to meet the desired goals. In these cases, a less selective technique may be appropriate.

Whatever techniques are warranted, advance warning of proposed routine vegetation management activities in the park shall be given to the Senior Park Ranger at least two weeks in advance of the work. Where immediate action is required to remedy a hazardous situation (e.g. a downed tree blocking the trail), written documentation shall be provided to the Senior Park Ranger explaining the condition, the reason immediate action was required and a description of the remedial action taken.

Vegetation Management –Work Tasks

Routine maintenance work required to achieve the vegetation management program objectives described above will involve:

- Identifing and protecting/flagging sensitive native vegetation prior to annual brushing
- Clearing the trail tread of encroaching vegetation to define and protect the established tread and to minimize tripping hazards
- Protecting trail users from hazardous situations by removing overhanging vegetation, fallen trees/branches to provide 8 feet of vertical clearance (minimum),
- Removing invasive, non-native plants
- Maintaining scenic vistas

Vegetation Identification, Management & Restoration Guide

Managing vegetation within the trail corridor requires a high degree of selectivity and knowledge about specific plant species that may be found along the trail. The trail crew must be able to differentiate between those species that are non-native invasive plant species that should be removed, and those species that should be retained because they are legally protected, add to the overall landscape character and/or protect the trail system (e.g. reduce soil erosion).

While botanists may find it relatively easy to differentiate between native and non-native invasive plant species, all work crews cannot be expected to have this level of expertise. To help crew leaders guide work crews in meeting the vegetation management objectives of this plan, it is highly recommended that the City work with volunteers to create a vegetation management field guide for Foothills Park.

This manual should include a section on the native plants that should be protected to enhance the natural ecology of the park and the non-native invasive plant species, which should be removed. The field guide should include photos of specific plants, a description of the plant and, where eradication is desired, recommendations on the appropriate tools that should be employed. The handbook should also include specific recommendations for revegetating disturbed areas in different ecological zones.

This vegetation management guide should then be used in the field by crew leaders to teach field crews how to differentiate between those species that are non-native invasive plant species that should be removed and those species that should be protected.

Habitat Protection & Enhancement within the Trail Corridor

Habitat Enhancement

Habitat enhancement is achieved by protecting and promoting the growth of native trees and shrubs and by planting and seeding native ground covers along trails. Habitat enhancement can improve the aesthetics of the trail, help minimize erosion, and provide for wildlife habitat. Habitat enhancement may involve mitigation of damage caused by wildlife, as well as humans (e.g. wildlife travelways that can cause erosion are sometimes enlarged by people using these corridors as trails).

Identifying, Flagging & Protecting Native Vegetation

The vegetation management program should strive to protect and enhance the natural plant ecology of the park and minimize water quality impacts resulting from soil erosion. This will best be accomplished by conducting a pre-maintenance biological survey for sensitive species prior to initiating any maintenance activities.

The purpose of the pre-maintenance survey is to determine if there are any federal or state listed endangered or threatened plant species or any other sensitive (e.g. plants identified on California Native Plant Society and Friends of Foothills Park lists) in the proposed work area. If any plant species are identified, they should be flagged, and where necessary fenced, prior to initiating any maintenance activities in order to protect them from impact during the period of maintenance work.

If any sensitive wildlife species are found during the pre-maintenance survey and the maintenance work would have the potential to harass nesting animals, timing for the proposed maintenance work in this area must be revised to avoid the nesting period.

Naturalizing Abandoned Trails

Developing the Plan - There are no cookbook answers for returning abandoned trails to their natural condition. Naturalizing abandoned trails requires as much attention and planning as constructing new trail segments. If proactive steps are not undertaken to naturalize an abandoned area, those same trails may still be visible, still be eroding and sometimes still carrying visitor traffic.

Therefore, each site should be evaluated for its potential to regrow and heal. On sites that are moist and relatively flat, it may be possible to block off the trail and allow rehabilitation to proceed naturally. On the other hand, dry, steep sites will take more work, and may take longer to recover.

The goal in developing a site specific naturalization plan is to ensure that almost all evidence of the trail is gone and to reduce future human and environmental impacts on the land. Naturalization strategies include closure, stabilization, recontouring, revegetation, and monitoring. The consequences of each strategy should be thoroughly examined with soil and plant specialists when planning a naturalization project to ensure successful naturalization with minimum impacts to the surrounding site.

Closing Abandoned Trails - Each abandoned trail should be closed. If the trail is not blocked to prevent further use, the trail may persist indefinitely. Closure is particularly important if stabilization and revegetation are being attempted. The abandoned tread should be blocked to all traffic, recontoured and disguised to prevent users from being tempted to use it. This work should be accomplished for all segments visible from trails that remain open.

Stabilizing the Abandoned Tread -Stabilize abandoned tread to prevent further erosion. Former trails break natural drainage patterns and can collect and concentrate surface water flows. By restoring the natural contour of the slope the local drainage patterns can be reestablished, which will reduce the likelihood of further erosion. Additionally, recontouring generally eliminates the temptation to use the old trail and facilitates revegetation efforts.

Revegetation – Areas where trails have been abandoned and areas adjacent to trails that have been disturbed for any reason should be revegetated where success can be anticipated. Revegetation can be accomplished passively or actively and should be evaluated on a case by case basis to minimize erosion. Passive revegetation allows for surrounding vegetation to colonize the site. This, however, could result in the invasion of non-native weeds and would require close monitoring. Passive revegetation works best when erosion has been stopped, adequate precipitation occurs, and adjacent vegetation spreads and grows rapidly.

Active revegetation ranges from transplanting on-site vegetation to importing genetically appropriate seed or propagated plants. Use of on-site vegetation requires the collection of seed from native plants from the immediate area and storing them for later use. Successful revegetation almost never happens in a single season. Refer to *Section 4.8, Table 4.9*, and *Section 6.6 Closing and Restoring "Renegade Routes"* for other methods of erosion control. Refer to *Section 4.5 Noxious Plants* and the Sub-section on tools for managing vegetation below for further discussion on controlling noxious plants.

Tools for Managing Vegetation

Manual Labor with Unmechanized Tools

Pulling and Prying – Pulling weeds by hand and/or prying using simple tools such as a weed wrench for leverage, offers the most selectivity of any management technique, and is the most time consuming. Pulling requires no special equipment or preparation. Because of its selectivity, hand pulling weeds offers the least environmental insult, provided pullers are knowledgeable regarding targeted species. Individuals with limited training can generally target one to three weeds successfully. Pulling and prying are most effective when the ground is soft enough that stems do not break off at the soil surface.

Grubbing and Hoeing – Hoeing cuts the roots off at, or beneath the soil surface with the sharp edge of a hoe or McLeod. Some plants will regrow, unless the worker pulls up the entire root and therefore, eliminates sprouting. Grubbing uses heavier tools, such as mattocks, Pulaskis, or picks to reach underground parts of the plants capable of growing new shoots. Gubbing and hoeing are faster operations than hand pulling. Both have nearly the selectivity of hand pulling. Grubbing and hoeing can be done when the ground is damp, but also after the ground hardens.

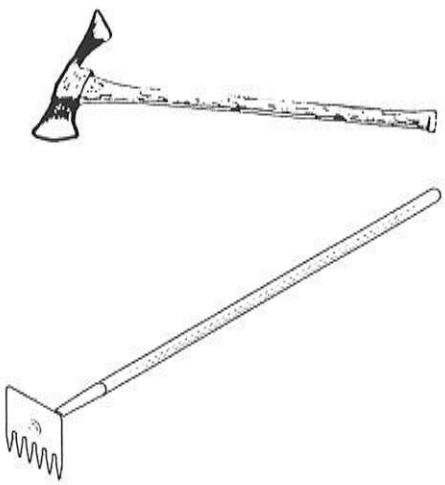


Figure 6-19
Pulaski and McLeod

Tuber saws – These small, curved folding saws are easily carried, and are efficient and easy to use because they cut on the pull stroke. A 7-inch blade cuts saplings cleanly at the base and most branches. Blades can be sharpened, but rarely need it.

Scythe, and lively lad – Tools such as scythes, and "lively lads" make horizontal sweeping cuts appropriate for small, fine, herbaceous material, including grasses. Cutting green material is most efficient when the plants are turgid, but not wet. When cutting after the plants have started to dry (cure), it is more efficient to cut when the material is brittle and dry, such as in the late afternoon. Sharpness of the cutting blade is critical to efficiency. A proficient operator with a sharp blade can mow quite quickly. Untrained operators will have difficulty regulating height and may leave ragged-looking material. The selectivity of this treatment is high, but less than hand pulling and grubbing or hoeing, as nearby plants are

likely to get cut in a swath. Like any other operation, other than pulling or herbicide use, this technique will only temporarily affect plants that crown sprout.

Machetes – Machetes are best used with green material; they do not work well with dead material. Machetes are most often used for general clearing, for pruning low branches and cutting up shrubs, rather than cutting brush at the base. The operator needs to observe safety precautions, including keeping a safe distance from others and to avoid hitting dirt which dulls the blade.

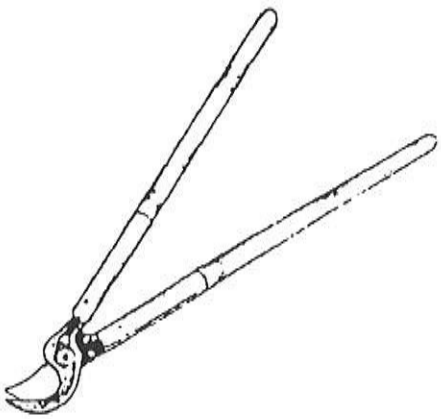


Figure 6-20
Loppers

Loppers – Loppers are used to prune low branches of trees and to cut brush stems that are smaller than 3 inches in diameter (depending on the type of lopper). Loppers are very specific, on a par with hand pulling. Loppers are also used to cut larger material into more manageable pieces, or for assembling piles, or to perform the "lop and scatter" operation. Work may go slowly because of the large amount of handling necessary to cut each piece.

Manual Labor with Mechanized Tools

Mowing with Weed Whips – Weed-whips, also known as "weed eaters", have cutting heads that are flat and cylindrical in shape, and hold two or more mono-filament nylon lines that radiate out from the head and cut the weeds as the head spins. Weed whips are gas or electric powered and hang from a shoulder strap or harness at the balance point on a shaft, usually at hip level.

Figure 6-21
Weed Whip

Mowing with a string cutter is an effective way to reduce fire hazard in grassy areas, but has mixed effectiveness in controlling weeds, depending on species timing of treatment, operators, and height of mowing. It is usually employed in areas too steep for wheeled mechanical equipment. It is also normally used for areas less than two acres in size.

When weed whips are employed, 4 to 6 inches of cover should be maintained to minimize exposure of bare earth and resulting impacts from splash erosion and gullying.

An experienced operator can maintain a great deal of control over which areas are cut and be able to maintain uniform cover over the area. An inexperienced operator

may have difficulty maintaining a uniform cut. String cutters will not cut large woody stems, but tree seedlings may be severely damaged.

Ear and face protection is essential when operating these machines.

Variations of weed-whips include hard plastic blades instead of or in conjunction with the nylon line, making it possible to cut thicker or tougher materials.

Brush Blades – Brush cutters and some brush clearing saws use the same basic design as weed-whips, but have a steel bladed cutting head. These blades are well suited for cutting fibrous or small woody plants at the base and for cutting debris into mulch.

Ear and face protection is essential when operating these machines.

Chain Saws- **Chain saws are dangerous. Proper training and appropriate safety gear is essential**.

Brush cutters are better adapted than chain saws for cutting small-diameter and brushy growth. Chain saw teeth tend to grab rather than cut through small, springy branches, causing the saw to be jerked toward or pushed away from the work, or kicked back toward the operator. Additionally, sticks often get caught between the saw chain and guide bar, causing the chain to derail.

Pole chain saws have the cutting bar located at the end of a telescoping pole, and are useful for cutting branches and limbs under three inches in diameter above the head of the operator.

Chain saws are best suited for cutting through solid wood, and are used for pruning, felling, and limbing operations. Green wood is often softer and easier to cut than dead wood; some hardwoods such as eucalyptus are especially difficult to cut when seasoned.

Since chain sawing involves cutting individual trees and shrubs, selectivity is very high, but work goes slowly. Slash can accumulate rapidly, and may need to be chipped, cut more finely to make piles for animal habitat, piled for later burning, scattered or hauled off the site.

Chain sawing can sometimes cause changes in habitats and micro-environments, loss of nesting sites for birds, loud noise during cutting operation, and impacts of equipment, if the material is hauled off site. Given the potential hazards associated with this machinery and the potential impacts on the environment, the use of chainsaws in managing vegetation should be carefully considered – and volunteer crews should never be authorized to use them.

Vegetation Management - The Ground Plane (1"–3' high)

Selective Brushing to Maintain/Restore the Ground Plane

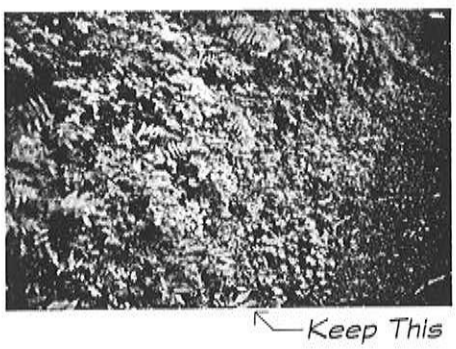


Figure 6-22
Brushing to Maintain the Ground Plane

Generally, low growing and slow growing shrubs and ground cover on the uphill and lower sides of the *trail corridor* should not be disturbed. This strategy will limit opportunities for invasive, non-native plants to gain a foothold in areas not already impacted. Where low growing vegetation must be cut back to correct a trail deficiency, revegetation of these areas should be encouraged to increase soil stability. Replant areas with vegetation indigenous to those areas or compatible with plantings already in place.

Within the *trail tread* plants and loose roots which presents a safety hazard (e.g. by protruding over one inch above the trail tread) should be cut out beyond the margins of the *tread* and 4 inches below *tread* surface and removed from the travelway. Holes resulting from root removal should be filled and compacted with native, mineral soil and or rock, not exceeding 2 inches in diameter.

Controlling Invasive Non-native Plants

There are a variety of tools that may be used to control non-native (exotic) species that are causing a hazard to users or creating a threat to a significant natural resource.

Appropriate management techniques include in order of preference, 1) removal by hand pulling, or pruning with weed whips or 2) adding organic mulch 3) biological controls (e.g. "beneficial insects" and/or fungi), or 4) (as

a last choice) applying chemicals. Herbicide applications and biological controls should only be used as approved by the Open Space Division Superintendent.

Use of biological controls - Research on specific biological agents, usually insects, has resulted in the release of some very specific insects. "Beneficial insects", where they have been determined through study not to have detrimental environmental impacts, may be considered as a management tool in the park.

In addition, research is currently being conducted on the use of fungi as vegetation management tool. For the most current information and specific recommendations on the use of biological controls, consult with the University of California Cooperative Agricultural Extension.

Hand Pulling or Pruning with Weed Whips – for a description of the various tools and their benefits and limitations, refer to the sub-section on tools provided in this section.

Adding Organic Mulch - Choosing appropriate wood chips and timing the placement of the mulch can be critical.

Organic mulches such as wood chips can retard the sprouting of weeds for as long as one season. Organic mulches can also be used to increase a population of a tree species by chipping branches that have ripening seed and spreading that mulch. Additionally, organic mulches can be beneficial in mitigating the effects of splash erosion.

However, infected wood chips may spread diseases to oaks and shrubs and use of mulch chips containing weedy species may tend to spread the weedy species.

Additionally, fungus is usually present in these mulches as the chips break down, so protective masks are important safety gear when applying organic mulches.
Using Herbicides – Herbicide use must be carefully considered. Herbicides should not be used for routine maintenance. They are poisons that may kill or harm desirable plants nearby, or have other negative effects in the environment beyond their intended use.

In addition, herbicide treated plants often have an unsightly, blighted appearance, and the dead materials may still need to be removed for fire hazard reduction or for aesthetic reasons.

In their proper setting, however, spot applications of herbicides may be used in exceptional circumstances, for site specific purposes only, where other methods are deemed ineffective for achieving a desired condition. For example, herbicides can be effective in selectively (through spot applications) killing plants that resprout repeatedly and are hard to pull from the soil.

It is almost always possible to find a herbicide of low ("caution") or moderate ("warning") toxicity for a particular use. These chemicals must be applied in accordance with California State law and must adhere to the conditions set forth in the City's "Integrated Pest Management Plan" to ensure the safety of staff, visitors and wildlife and to reduce or eliminate chemicals from entering the creeks.

Broadcast spraying is not selective because it sprays the herbicide over an area. This method may have extensive adverse environmental impacts and should be avoided. Those herbicides of high toxicity ("danger of" or "poison") should also be avoided altogether, in favor of less toxic or non-chemical methods.

For information and recommendations on the use of herbicides, consult with the University of California Cooperative Agricultural Extension or Licensed Pest Control Advisors or the County Agricultural Commissioners office.

Vegetation Management – The Middle Plane (3'–10'high)

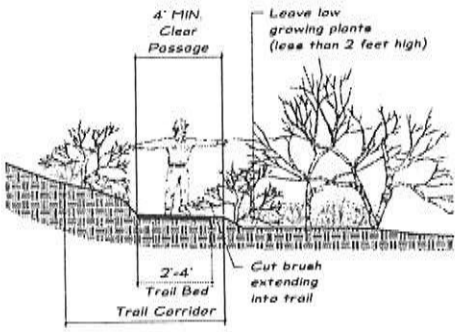


Figure 6-23
Pruning Shrubs

Clearing and Bushing to Maintain a Clear Passage

Brushing refers to the removal of shrubs that are over-hanging into the *trail bed.* Woody vegetation that fills in the middle plane (3-10 feet above the ground surface) is typically woody material. This material should be brushed carefully, giving consideration to the type of vegetation. Some plants can be trimmed back further because they tend to grow back quickly. Others may take years to grow. Rangers who become familiar with the plants of the chaparral plant community will be able to set up effective annual and cyclical vegetation management programs.

No rare shrub species shall be brushed back or pruned unless absolutely necessary for the hiker's safety. Then selective pruning shall be done under the guidance of a qualified botanist or other expert with knowledge of the species.

Typically, branches of the shrubs should be pruned back to provide 4 feet of clearance along the trail tread. However, a "scorched earth" look is not pleasing to the eye and can increase erosion within the trail corridor. Therefore, it is important to work with the natural vegetation patterns to "feather" or meander the edges of the clearing work so they don't have a severe appearance or create bare areas that will be subject to erosion and establishment of non-native plant species.

Intruding brush should be cut back at the base of the plant rather than in mid-air at the clearing limit boundary, except where is will result in over widening the trail bed or over clearing the corridor. Where appropriate, cut all plant stems and stumps close to the ground. In especially sensitive areas, cover the stumps with dirt and leaves.

When pruning back shrubby vegetation, be conscious of the way this type of vegetation affects how people walk on the trail tread. Hikers will tend to avoid brush that extends onto the trail. As a result, brush that intrudes into the passageway may encourage people to walk on the trail shoulder and breakdown the edge of the tread.

Where a trail is located on a side slope, the shrubby vegetation on the uphill side will be more invasive and intrusive to hikers and should be cut back more severely than on the downhill side.

Brush that is pruned should be grubbed out and disposed of out of sight of the trail and scattered, not stacked, so that it blends with the natural surroundings as much as possible. Do not dispose of materials in stream channels, ditches, drainage, or other waterways.

Clearing and Bushing to Reduce Fuel Loads

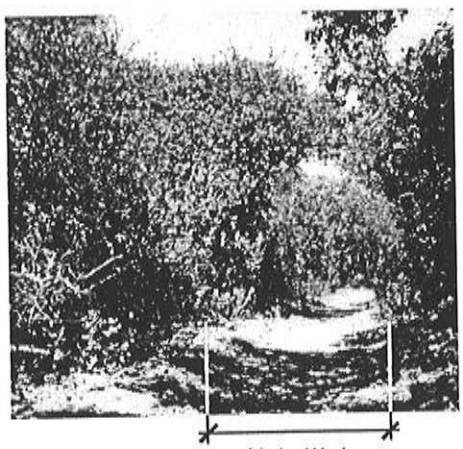


Figure 6-24
Clearing Brush to Reduce Fuel Loads

The objective of this type of clearing and brushing is to reduce fire danger, while allowing the native forest and understory to persist. Therefore, the focus should be on removing invasive exotics such as broom, which contribute to the overall fuel load but contribute little to the natural ecology of the park. Other non-native perennials and woody invaders that should be included in the fuel reduction program include, but are not limited to, thistles and poison hemlock.

In addition, poison oak and coyote bush are native plants that should be included in the vegetation management control program. These plants, while native to the foothills of this area, grow aggressively and displace other native plants in the absence of control mechanisms.

In determining the most appropriate techniques to use, it is important to make vegetation management decisions that will enhance wildlife diversity. It is important to remember that all vegetation – even exotic - supports wildlife; many native animals have in fact adapted to naturalized plants. Therefore, it is best to take a studied, careful, low-impact, long-term approach to fuel reduction in park, with the high focus being placed on the management of fuel loads that potentially have the greatest impact on adjacent residential properties.

To determine appropriate methods for removing these plants refer to the discussion on the use of tools and pruning guidelines in this sub-section. The methods selected will need to be tailored to minimize risk to sensitive species. The most specific methods, such as hand-pulling and pruning, may impact species least. More broad scale methods such as the use of weed whips

may not be suitable when native plants are emerging or blooming, or when sensitive animals are using the plant cover.

Finally, to ensure that an effective balance is being made between habitat protection and visitor safety, the development of a fuel reduction program for Foothills Park must be coordinated between the City Departments of Open Space and Sciences and Fire.

Controlling Aggressive Natives – Poison Oak

Active measures should be used to control poison oak where it threatens to encroach into the trail corridor and pose a treat to hikers. Pruning should be performed to provide a clearing width of 4 (minimum) feet or further if pruning will only occur once during the season, because poison oak tends to grow back quickly. Where a trail is located on a side slope, the shrubby vegetation on the uphill side will be more invasive and should be cut back more severely than on the downhill side. In areas with heavy stands of poison oak, the trail may need to be brushed back twice during the growing season to maintain a clear passageway where hikers will not be forced to brush against these plants. Brush that is pruned should be grubbed out and disposed of out of sight of the trail and scattered, not stacked, so that it will blend with the natural surroundings as much as possible. Do not dispose of materials in stream channels, ditches, drainage, or other waterways.

Safety gear including long sleeves, gloves and long pants should be worn when pruning poison oak so that workers do not come in direct contact with the plants. This vegetation should not be burned because the smoke can cause a toxic reaction if inhaled.

Vegetation Management - The Overhead Canopy

(The Archway Over the Trail Corridor more than 10' High)

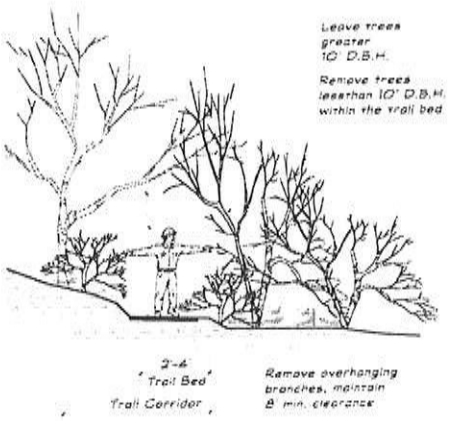


Figure 6-25
Pruning Trees

Figure 6-26
Variations in Standard Width of Clearing

Limbing Overhanging Branches

In heavily wooded areas overhanging limbs that may affect travel within the trail tread should be selectively pruned back to provide a clearing width of 4 horizontal feet and 8 vertical feet. This will allow an average hiker carrying a child in a back carrier to move freely along the trail. Figure 6-25Figure 6-26

While pruning may be necessary for the safety of the trail visitor, it is also important to retain the integrity of the overhead canopy. Retention of the overhead canopy will benefit the natural character of the understory by slowing the growth of grasses and shrubs that grow in sunlight. The overhead canopy will also protect the trail by minimizing the impacts of splash erosion.

Overhanging limbs that need to be pruned should be cut back flush with the tree trunk. Branches cut flush will not only look better, they will not be hazardous to trail users. Dead and dying limbs and snags, which may fall on the trail, should also be removed. Stumps should be cut at ground level or below.

Unsightly cut-off branches may be a route for disease to enter the tree. Take the extra time and effort to get the loppers or saw close to the tree before cutting. When cutting with a saw make a shallow undercut first, and then follow with a top cut. This allows for a clean cut and prevents the limb from peeling bark of the tree as it falls. These practices will promote the good health of the tree.

Variation in the Standard Width of Clearing

While four feet is the average standard width of clearing, some variation should be allowed and encouraged – it is visually appealing and often more sensitive to the adjoining natural resources. Occasionally, for example, in wooded areas it may be desirable to narrow the clearing width to route the trail between two large visually interesting trees, than to reroute the trail or remove one of the trees.

Figure 6-27
Leaners

Leaners

Leaners are those trees, which are leaning towards or into the trail corridor that could restrict access along the trail. If they are not already interfering with the safe passage of hikers, they may be on their way toward interfering with the trail corridor and may soon present a hazard.

Any leaner which shows evidence of impending failure should be cut whenever possible. Leaners should be cut flush with the ground level and the stump should be buried. Felling standing trees including leaners and snags, especially ones that are hung up in other trees, can be very hazardous and should only be done by a certified arborist that has been formally trained in felling trees.

The fallen tree should be dragged into the forest so that it is not visible from the trail. To further minimize visual impacts, turn freshly cut ends of the logs away from the trail.

Downed Trees

Downed are those trees, which have fallen into and are obstructing the trail passageway. These trees should be removed to provide for the safe passage of hikers. The entire tree does not have to be removed from the corridor, which could be disruptive to other vegetation. Rather, the portion of the tree that is obstructing the passageway, or causing a threat to hikers within the passageway, should be cut and removed from the site.

6.9 Los Trancos Creek Corridor Trail Maintenance as It Relates to Creek Resources

The ecology of Los Trancos Creek has the potential to support a diverse number of microhabitats that are favorable to species which are listed as Threatened by the federal government and are protected by the National Marine Fisheries Service and the US Fish and Wildlife Service. Trail maintenance activities could result in direct or indirect impacts to the ecology of this creek corridor by altering these microhabitats. Therefore trail maintenance along Los Trancos Creek must be undertaken with extra care so as not to harass or impede wildlife movement or adversely impact water quality in the creek. A key to the recommendations for performing trail maintenance with the Los Trancos Creek corridor is provided below.

Los Trancos Creek Corridor

Los Trancos Creek Corridor Setting

Los Trancos Creek forms the northwestern boundary of Foothills Park. The portion of the creek that is in the park is deeply incised, rocky, and fully shaded with a high overstory of bay laurel trees, but virtually no cover along the creek banks. The Los Trancos Trail parallels the creek for 1.75 miles. The trail meanders up and down along the creek. While the creek is quite close and accessible from the trail in some locations, most of the time the trail is at least fifty feet above the creek on a steep slope. The trail crosses 17 tributaries to the creek. Eleven of these sites are bridged (Los Trancos Bridges # 10 through 20), and six are not.

Los Trancos Creek Corridor Resources of Concern

Los Trancos Creek contains pools and riffles of clear cold water which provide habitat for Steelhead trout (*Oncorhyncus mykiss*), which migrate up the San Francisquito drainage from the bay. The steelhead run in the San Francisquito Creek watershed, including Los Trancos Creek, is listed as Threatened by the federal government and is protected under the Endangered Species Act through the National Marine Fisheries Service. Los Trancos Creek is a particularly important resource for steelhead in the San Francisquito Creek watershed because of the cool, clear water habitat that it provides . Other drainages in the watershed (San Francisquito Creek, Bear Creek) are more heavily impacted by sediment and structures in the creeks.

Los Trancos Creek is also habitat for the California red-legged frog (*Rana aurora draytonii*). The California red-legged frog is listed as Threatened by the federal government and is protected under the Endangered Species Act through the US Fish and Wildlife Service. The portion of the creek in the park may contain breeding habitat (although a survey has not been done), and it may provide a corridor of travel between robust populations of CRLF west of the crest of the Santa Cruz Mountains and populations known in and near Los Trancos Creek on the east side of the mountains. Breeding populations are known downstream in stock ponds along the creek corridor.

Los Trancos Creek may also provide habitat for Foothill yellow-legged frog (*Rana boylii*; federal species of concern; state species of concern; state protected), which occurs in or near rocky streams in a variety of habitats. It requires permanent water and dense cover.

Trail Maintenance Issues

Trail maintenance activities could result in direct or indirect impacts to the ecology of the creek corridor. Features that are important to the ecology of Los Trancos Creek are those which support a diverse number of microhabitats for wildlife and insects:

- Cold, clear water.
- Pools.
- A combination of overhanging vegetation and clearings.
- Areas that are shaded and areas that get sun.
- Rootballs and cutbanks (places for fish to shelter).
- A combination of steep banks and more gently sloped banks.
- Water year round.

Where Los Trancos Creek parallels the Los Trancos Trail in Foothills Park it supports most of these features; the exceptions currently are overhanging vegetation and cutbanks which provide shade and places for fish to shelter. These features could develop in the future. Water levels drop significantly in the summer, but deep pools remain for oversummering. Any maintenance activities which reduce the diversity of the microhabitats, or which impact water quality could adversely affect the ecology of the creek. In addition, California red-legged and Foothill yellow-legged frog migrate away from the creek and into the surrounding woodland at drier times of the year, and thus require access to habitats outside of the creek zone. Trail maintenance should not result in structures that impede wildlife movement, including amphibians, and should not remove the duff on the forest floor which provides cover for amphibians.

The goals of trail maintenance in the Los Trancos Creek corridor are:

- Control erosion to reduce the amount of sediment introduced into the creek.
- Allow understory vegetation to develop along the creek corridor, and limit vegetation management to the footpath.
- Leave the duff and leaf litter.
- Handle the soil which sloughs from the bank above the trail in a way which does not adversely impact water quality in the creek.
- Allow for the unimpeded movement of wildlife between the creek corridor and adjacent habitats.

Regulatory Setting

National Marine Fisheries Service

Because the steelhead trout depends on ocean waters for part of its life cycle, the National Marine Fisheries Service is responsible for the regulatory actions related to protection of the steelhead trout under the federal Endangered Species Act. Any actions which may result in the "take" of protected runs of steelhead trout,

including killing, harassing or preventing breeding, are subject to the provisions of the Endangered Species Act. "Take" of steelhead from protected runs without a permit is subject to criminal penalties under the Act.

US Fish and Wildlife Service

The US Fish and Wildlife Service is responsible for the regulatory actions related to protection of the California red-legged frog (CRLF) under the federal Endangered Species Act. The US Fish and Wildlife Service prepared a recovery plan for this species which provides recommended actions needed to prevent the species from becoming extinct and for it to regain population levels that will allow it to be removed from the endangered or threatened species list. Any actions which may result in the take of CRLF, including killing, harassing or preventing breeding, are subject to the provisions of the Endangered Species Act. Take of CRLF without a permit is subject to criminal penalties.

Regional Water Quality Control Board

The Regional Water Quality Control Board for the San Francisco Bay Region (RWQCB) is the local regulatory arm of the State Water Resources Control Board. This agency oversees the creation and enforcement of regulations that protect water quality in waterways in California. The RWQCB regulates discharges into waterways which could impact water quality, including stormwater runoff as well as soil or debris.

The California Department of Fish and Game

The California Department of Fish and Game (CDFG) is a trustee agency which reviews and comments on projects which may affect the state's wildlife resources, and is a regulatory agency which develops and enforces the Fish and Game Code. Modifications to streambanks or beds requires a Streambed Alteration Agreement under California Fish and Game Code /
Trancos Creek Corrido-

Vegetation Management in the Los Trancos Creek Corridor

As noted in *Section 6.8,* vegetation management activities should be limited to what is necessary to keep the footpath open and reduce hazardous conditions.

Drainage and Erosion Control Techniques in the Los Trancos Creek Corridor

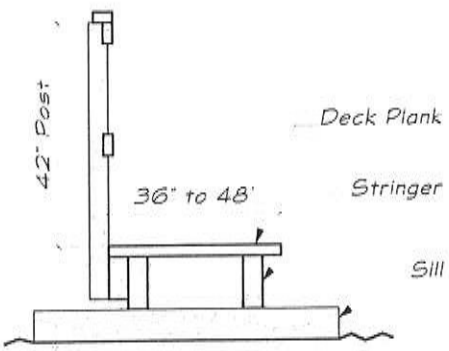
As noted in *Section 6.6*, the goal of managing drainage is to have a trail design that sheds water rapidly, without permitting a build-up of velocity or volume that can result in erosion. Methods included in the plan are drain dips or drainage swales, and water bars. With regard to the section along Los Trancos Creek, drainage management should specifically avoid directing water in such a way that it would increase erosion and thus the sediment load in the creek, carry additional debris into the creek, or de-stabilize the creek banks. This is because increased sediment or debris could adversely affect sensitive species by impacting water quality. Structures placed to stop erosion, such as retaining walls, should not be higher than three feet tall unless it can be shown that the structure would not impede amphibian movement. All work along Los Trancos Creek should be completed during the dry season.

Litter and Slough Management in the Los Trancos Creek Corridor

The guidelines in this handbook encourage leaving leaf litter on the trail tread, and providing for the removal of soil slough to maintain the pathway. Often the soil slough is moved from the upper side of the trail to the lower side of the trail. With regard to the section of Los Trancos Trail along Los Trancos Creek, it will be beneficial to leave naturally occuring leaf litter on the trail tread to reduce the chances of erosion. Soil that has sloughed onto the trail bed should not be moved to the downhill slope in areas adjacent to the creek because it will likely continue downslope movement into the creek, potentially causing a cumulative impact on water quality in the creek which could affect the sensitive species habitat. Soil slough should be removed to a portion of the trail where fill is needed to repair tread conditions, or to portions of the trail that do not border the creek. All work done along Los Trancos Creek should be done during the dry season.

6.10 Techniques & Tools Maintaining Trail Structures within the Trail Corridor

The main consideration in structure maintenance is safety. Where trail structures are employed, they should be constructed with quality materials that harmonize with the surrounding environment. To ensure that structures are adequately maintained to provide for the safety of the trail visitor, inspections should be recorded in the Maintenance Log so that repair/ replacement of these items can be anticipated, budgeted and scheduled. A key to the recommendations for performing trail maintenance on trail structures is provided below.



Trail Structures – General Information

Bridges

Steps

Trail Structures - General Informaiton

Trail Structures Defined

Trail structures as defined in this handbook refer to the constructed, man-made elements within the trail corridor, which facilitate a safe, pleasant trail experience. Trail structures typically respond to user safety and environmental protection issues, though they may also apply to user convenience issues (e.g. benches). Structures, such as bridges, facilitate passing through or across wet areas or open drainages, while steps and switchbacks are used to overcome topographical restrictions.

Routine Inspection & Repair/Replacements

Where trail structures are employed, they should be constructed with quality materials that harmonize with the surrounding environment.

The main consideration in structure maintenance is safety. To ensure that these structures are kept in good repair the structures maintenance program should include:

- Routine inspection of benches, bridges, handrails, and steps to ensure that all the structural members are in safe condition and are able to serve their intended function.
- Repair /replace of weak structural members.
- Correction of tripping hazards (e.g. loose nails, uneven approaches to bridge decking, loose or protruding members on step risers).
- Repair of slough containment walls and retaining walls that hold the trail bed in place.

If repair/replacement work must be temporarily deferred, the structure should be cordoned off and in the case of bridges, steps, and handrails, an alternate trail route should be recommended at the trailhead that will bypass the hazard.

Trail Maintenance – Structures

Bridges – Correct Use and Placement

Definition/function - Bridges are structures used for crossing permanent and seasonal creeks, dry ravines or gorges and other obstacles in an environmentally friendly manner.

Safety of the user is the primary reason for designing and building bridges. Not only can it be unsafe to ford a creek, but descending steep, often slippery creek or ravine embankments can also be dangerous because of slipping and falling hazards. A steeply descending trail is also a source of erosion that can degrade water quality.

For these reasons the use of bridges is highly encouraged, even when crossing small streams or dry ravines. On the other hand, constructing and maintaining bridges is a major, long-term investment. Bridges are expensive to build, require regular inspections, and need frequent maintenance.

Inspection - All the existing crossings should be reviewed to determine whether or not the bridges are really needed. Inspections should include a review of the abutments, decking, structural timbers and railings. Where a bridge is necessary, the location should be carefully evaluated.

Bridges must be built with an adequate opening to accommodate floodwaters to survive. Determining peak flows is a complicated process that considers specific elements such as the size of the watershed, historic precipitation and historic debris flows. Therefore, the City should have a licensed engineer review existing sites where bridges have been damaged by winter storms in the past to look at options for relocating or rebuilding these bridges.

The use of railings should also be carefully evaluated taking into account the expected user and the potential hazard of falling. Routine inspections and maintenance are critical where handrails are incorporated into the design of a bridge. Lack of maintenance can lead to failure if railings can become decayed or fasteners become loose.

Failure- If a bridge is washed out as a result of winter storms, carefully examine the site to determine why it was washed out and what, if any, improvements in site and location can be made to lengthen the life span of the replacement bridge. In particular inspect the abutments, the creek bank, and sill logs for signs of slumping caused by scour eddies that may have undercut the bridge's support and altered the hydrology of the river. If evidence of scour is found, redesign or relocation of the abutments may be necessary. This should be done in conjunction with a licensed engineer.

Bridges – Monitoring for Repair/Replacement

Bridges that will need to be monitored for future repair/ replacement after heavy storm years include:

- Los Trancos Bridge #3, which is in the path of an active debris flow.
- Los Trancos Trail Bridge #5 where an area under bridge is being undercut by seasonal drainage.
- Los Trancos Trail Bridge #9 where the retaining timbers have been displaced and the tread is being undercut.
- Los Trancos Trail Bridge #11 which was covered with mud during winter storms of 1988 (repair work completed by CCC in the summer of 1988).
- Los Trancos Trail Bridge #14 which was washed away by a debris flow and needs to be replaced.
- Fern Loop Trail Bridge #2, which is in the path of an active debris flow.

Figure 6-28
Split Rail Bridge

Split Rail Bridge

Los Trancos Trail Bridges 7 and 8 are typical of many of the bridges in the Park. These bridges have split rail logs decking which are moss covered and very slippery in wet weather. There are no safety railings, though the drop off is typically more than three feet. These bridges should be replaced with either a "Type 1" or a "Type 2" bridge (see description of the two types below), depending on the volume of use, the bridge location and drop off of the surrounding terrain.

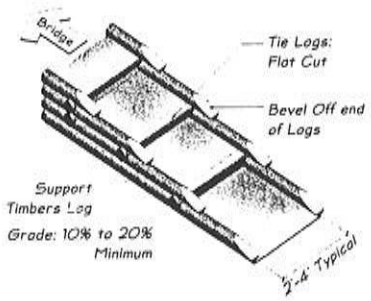


Figure 6-29
Bridge Approaches

Bridge Approaches

If the trail does not meet the bridge at deck level, an approach should be constructed of logs or rocks to bring the trail up to the grade of the deck. Approaches should be between 10 and 20% in grade. The tread can be compacted soil with or without step-ups or retainer bars or riprap depending on the differential between the tread and the deck. The bridge approach should have a width equal to the width of the bridge deck at a minimum.

Table 6.8 Design Standards for Bridge

Bridge Standards	Type 1	Type 2
Decking Width	48"	36"
Railings/height	Yes - 42"	Railings are req. if (1/2length x height2)/width > 40"
Clearance under bottom of decking	Dependent on site water & debris flow calculations	
Engineering req. to review site & bridge design	Yes	If length > 25ft. or height is > 5 feet or if structure is threatened by water or debris flows during storm events

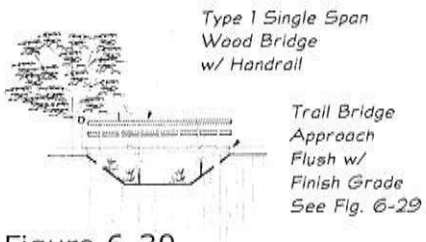


Figure 6-30
Type 1 Bridge

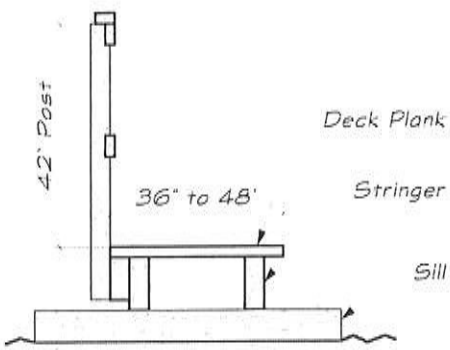


Figure 6-31
Handrails

Wood Plank Bridge with Handrails (Type 1)

In some situations a railing is necessary and can increase the comfort level of users. When determining whether to incorporate a railing in the bridge design, consideration should be given to the swiftness of the water during and after winter storms, the height of the crossing above the ground or water, the anticipated level of maintenance, the character of the trail and the anticipated user experience.

Bridges located in high volume areas within 1 to 3 miles of the staging areas typically should incorporate handrails so less experienced hikers and/or hikers who are less sure footed will feel comfortable using the trails. Where it is determined that railings are necessary, they should be 42 inches high. The handrails should be designed so that children cannot easily slip through.

Los Trancos Trail Bridge 1 was built by the CCC in 1999 and should serve as a prototype for future bridge replacements where the crossing has drop-offs greater than 3 feet and the site is near the park activity centers or where a site is heavily shaded resulting in the decking remaining wet and slippery throughout. This bridge has a trail tread approach that is flush with decking. The decking provides a firm footing and the bridge incorporates handrails into the overall design.

Figure 6-32
Plank Bridge Without Handrails

Wood Plank Bridge without Handrails (Type 2)

In situations where there is little danger (e.g. the drop off is less than 3 feet) and/or the site is remote, the setting is natural, and the expected use will be by skilled hikers, the inclusion of railings can alter the character of the trail and the user experience. In these cases, a bridge railing may be considered as over-building the environment.

In these cases Los Trancos Bridge #9 is a bridge style that is frequently used in the park, which could adequately serve the intended user with some minor design modifications. The wood decking, which generally provides a reasonable footing, should be secured with deck screws. 1/2" spacing should be provide between planks to premote drainage. Rough sawn, deck, planks should be used to promote traction. A 2" x 6" curb edge should be secured to the outer edges of the decking to define the bridge edge. The approaches of the bridges should be modified to provide a smoother transition.

Design Standards for Steps

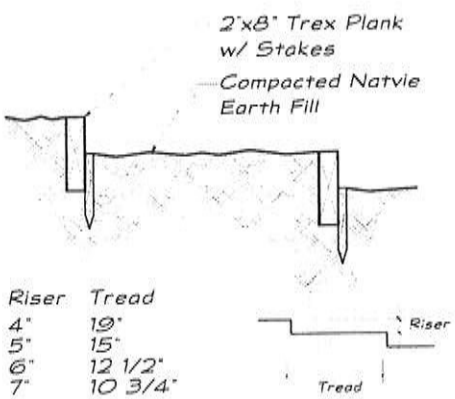


Figure 6-33
Steps Tread/Riser Proportions

Steps are generally recommended for short stretches of trail where the grade is steeper than 25%. The steps need to be comfortable to use. This means keeping the rise 4 to 8 inches and the run (tread) long enough to hold a hiker's entire foot.

Build the stairways from the bottom up, beginning at a break in the grade. If the trail is started part way up the grade, the trail will wash out below the stairs. It is often helpful to armor the side of the steps with rocks to encourage users to stay on the steps.

If the stairway climbs straight up the hill, each step should be slightly crowned to drain water to the edges or slightly sloped to one side. When the trail traverses a slope, each step and landing should be slightly outsloped. Water should not be allowed to descend long lengths of a set of steps (like a waterfall) or to collect on or behind a step on the landing. Incorporate a drain dip close to where the trail approaches the top of the steps to minimize the volume of water running down the steps.

Figure 6-34
Prototype Steps

An important area to watch during maintenance inspections is the outside edge of the step. Almost all foot traffic descending the step will walk off the edge. To prevent the risers from being dislodged by traffic, the steps must be seated well. The top of the step and the landing should be stable and provide secure footing. The face of each step should not create an angle, where the top edge is greater than 2 inches off vertical from the bottom edge.

Prototype Step Design

The steps located along the Fern Loop Trail should serve as the prototype for future trail step replacement. The California Conservation Corps constructed these steps in 2001. The risers are made of "Trex", a recycled material composed of a mix of wood chips and polymer. The height of the risers is approximately 4 inches. The tread is compacted native soil fill.

Design Standards for Benches

Figure 6-35
Memorial Bench

Rest areas should be incorporated into the trail network. These rest areas should be located along the trail where the terrain will naturally allow (site grading should be minimal, if required at all) and where they will enhance the visitor's park experience (e.g. view site, at the end of a steep grade). In some cases the "bench" may consist of natural features such as logs or boulders, which have been strategically placed for a hiker to take a break.

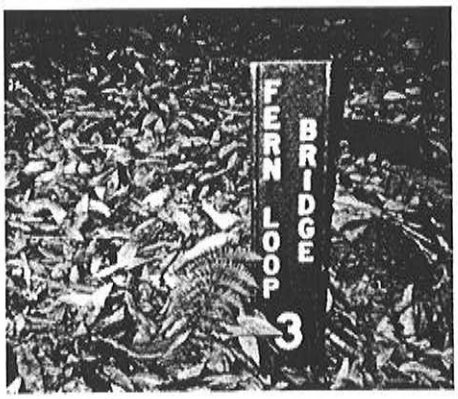
In a very limited number of other cases, a more formal structure may be desired. Where a more formal sitting area is desired, the standard memorial benches selected under the City's *Adopt-a-Park Memorial Program* have been installed in the past and should continue to be used adjacent to trails. These benches have been designed to harmonize with the surrounding environment. They are well-crafted benches constructed of recycled redwood with a bronze tribute plaque set in the bench's back.

The maintenance program for these benches should include routine inspections and maintenance associated with routine wear and tear (e.g. repairing loose connection points, refinishing wood components), as well as damage from vandalism. A bench that exhibits signs of wear, or has been vandalized, will detract from the

overall park setting at the very least, and can be hazardous to visitors. Replacement benches should be purchased from craftsmen in Arcata, California or an equal source.

6.11 Guidelines for Developing & Maintaining Trail Communication Tools

The focus of maintenance activities associated with the signs, brochures and maps is to disseminate trail information in a functional and inviting manner that minimizes clutter on the trail and the potential for graffiti, litter and other types of vandalism. The point of access should be inviting and easy to find. Trail signs should be well maintained and clearly identify the trail routes.



Trail Signs Standards & Maintenance

Trail System Map/Brochure

Interpretive Guides & Programs

Disseminating Trail Information - Providing & Maintaining Communication Tools

Information will primarily be provided to hikers through maps and brochures distributed at sites away from the trails (e.g. visitor center, entry kiosk), and secondarily through signs on the trails. Trail signs should be limited to trailhead signs, bridge identity markers and trail directional/signage markers.

Trail Sign Standards and Maintenance

The primary function of the sign maintenance program is to clearly identify the trail entry points and trail junctions so that a hiker unfamiliar with the area can easily identify where they are and determine a travel route that is appropriate for their desired experience.

Figure 6-36
Entry Sign

Trail Signs – Entry Points

The point at which people access the trail is often referred to as a trailhead. These points of access should be inviting. Trailhead signs should be visible to someone trying to find it and they should be well maintained and free of graffiti and other types of vandalism.

Trailhead signs for the park are made of redwood. Two redwood 4"x4" posts support the signs. The lettering standard is yellow painted, routed letters. The font size is 1" to 2" for headers and 1" for text. Information includes the name of the trail and the mileage to the next trail junction.

It is recommended that Universal Access Information be added to the information currently given in the trailhead identity signs.

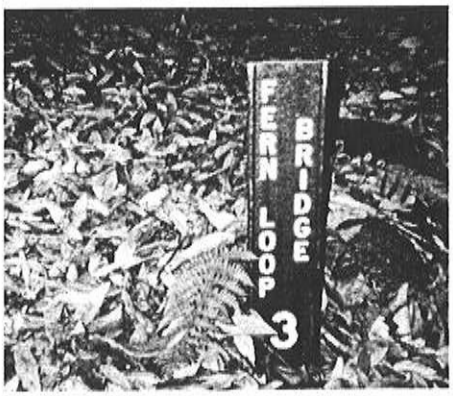


Figure 6-37
Bridge Identity Sign

Trail Signs - Bridge Identity

A yellow number on a 4" x 24" high, brown Carsonite marker identifies each of the trail bridges. These identity markers should be maintained and keyed to the park trails map. They can help to orient trail visitors, assist in emergencies and schedule maintenance by providing locator points along the trail system.

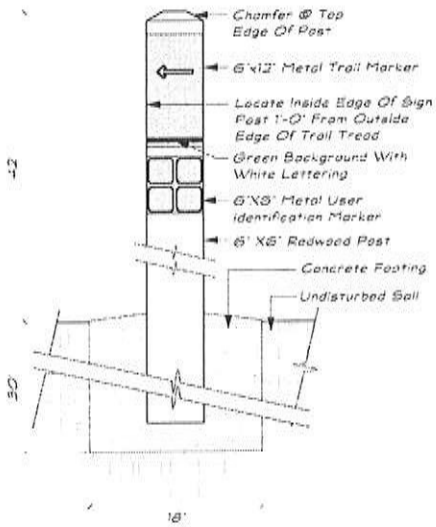


Figure 6-38
Directional/Mileage Marker

Trail Signs -Directional/Mileage

The City of Palo Alto is developing a new sign program for trail markers along the route. It will generally follow the trail signage program developed for Poganip Park in Santa Cruz County. This standard has 6"x6" redwood posts with trail markers bolted in place. The trail markers will show trail names, destinations and mileage.

As a general rule, directional/mileage signs should be located at all major trail junctions and trailheads. Signs should be placed so that they are visible to the trail user, but not so close as to interfere with the safe passage of hikers. Securely achor the post deeply and solidly into the ground (24 inches minimum).

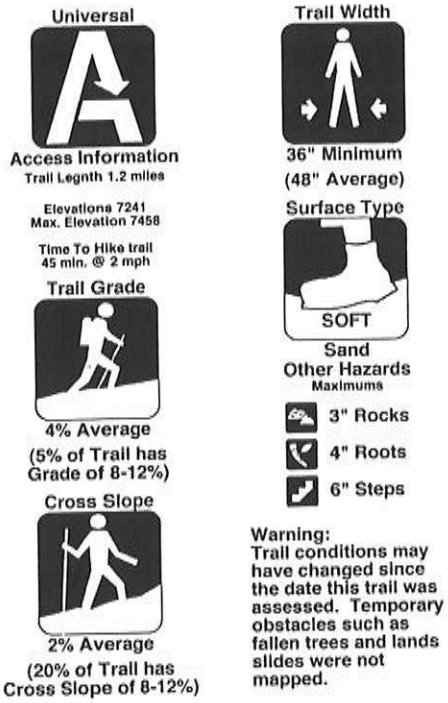


Figure 6-39
Universal Access Symbols

Trail Signs –Universal Access Information Signage

The City is currently having their trail systems analyzed for the purpose of generating Universal Access Information about individual recreation trails. While most of the trails in Foothills Park do not meet the desired accessibility goals with regard to trail steepness or width, use of the universal access signage system will give visitors an understanding of the park trail system. This information will enable all visitors to make appropriate decisions regarding the use of the trails. This information can be incorporated into trail guide products, such as trailhead signage and trail maps.

The Universal Access Information trailhead sign should include text and graphic displays indicating the average and maximum grade and cross slope, the average and minimum trail width, and the surface characteristics of the trail, such as the size and type of obstacles that will be found along the route of travel.

This information can be pre-printed on a vertical sticker that would adhere to a 24" x 36" Carsonite sign. When using Carsonite post, the optional anchor at the bottom should always be installed. This will make the sign harder to remove from the ground, while adding little expense.

Figure 6-40
Warning Signs

Trail Signs –Temporary/ Permanent Closures

Periodically whole trails or segments of trails will need to be closed temporarily. Reasons for closure may include:

- Major repair or seasonal maintenance
- Hazards associated with critical fire danger
- When a hazardous condition such as a landslide or washout has occurred
- During periods of flooding or extremely wet weather where such weather renders the trail dangerously slippery or where use would damage the trail.

When a trail is temporarily closed for these or other reasons, notice of the closure should be posted at all affected trail entrances and barriers should be placed at strategic points.

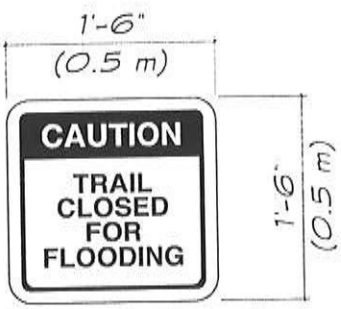


Figure 6- 41
Temporary Closure

Trail closure notices should include the reason(s) for the closure, what steps will be taken to correct the problem; an estimate of how long the trail will be closed and a telephone number for further information.

Trail closures should be as short in duration as possible and repair work shall be completed as necessary. The trail should be reopened when there is no longer a danger to public safety or potential long-term affects on the trail setting have been mitigated.

In addition to notifying visitors of hazardous conditions, trail closure signs may be warranted as part of an environmental trail closure and/or restoration process. These signs should be installed stating "Area Closed: Habitat Restoration" at trail junctions leading into the restoration area.

These signs and any protective fencing or barriers that are installed to protect a restoration site should be removed when the reason for the signage is no longer relevant.

Trail System Map/Brochure

The City should develop a new trails map. It should describe trail conditions for all the trails in the park using the Universal Trail Assessment system.

The map should include information on cross-slope, grade, trail width, tread material, and obstacles. This information may be conveyed through a top view map, a profile map, and an obstacle locator key. The map may also include information about the trail (e.g. vegetation communities) and associated park facilities (e.g. visitor center, restrooms, drinking fountains, and picnic areas) and trail usage information (e.g. hikers only, limitations on dog-walking, restrictions on other types of use).

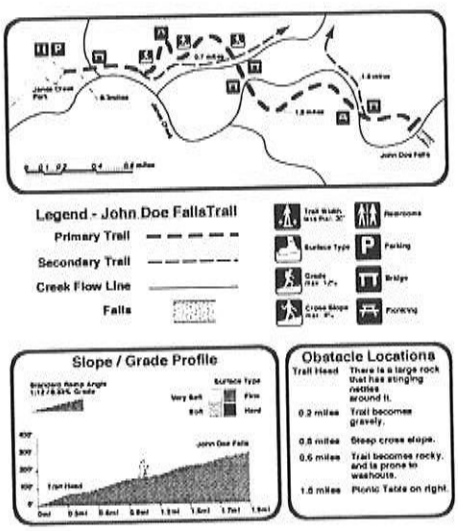


Figure 6-42
Universal Access Map Legend & Symbols

Interpretive Trail Guides & Programs

Interpretive trail guides and programs can serve as a valuable tool. These tools offer the opportunity to educate visitors about the biological diversity of Foothills Park and the importance of staying on trails to avoid damaging this unique resource. If presented in the right format, interpretive trail guides and programs can also serve as a recruitment tool to develop new volunteer maintenance crews.

JO/5/28/02

Trail Maintenance Standards for Foothills Park

The standard trail in the park provides four feet of clear passage with an 8 foot height clearance. (The clear passage includes a trail tread of at least two feet at ground level plus brushed area at the trail sides as needed to complete the four feet.)

Definitions: Trail Tread - The flat part of the trail where people can walk. Part of the trail tread is usually cleared tread which is maintained by foot traffic.

Clear Passage - A 3 dimensional area that is kept open to enable hikers to proceed without difficulty.

Brushing - Removal of plant material within the clear passage which would otherwise harm hikers.

Goal: Keep the trail serviceable and reasonably safe while providing the least disturbance to the natural setting.

Motto: Less Is Often Better

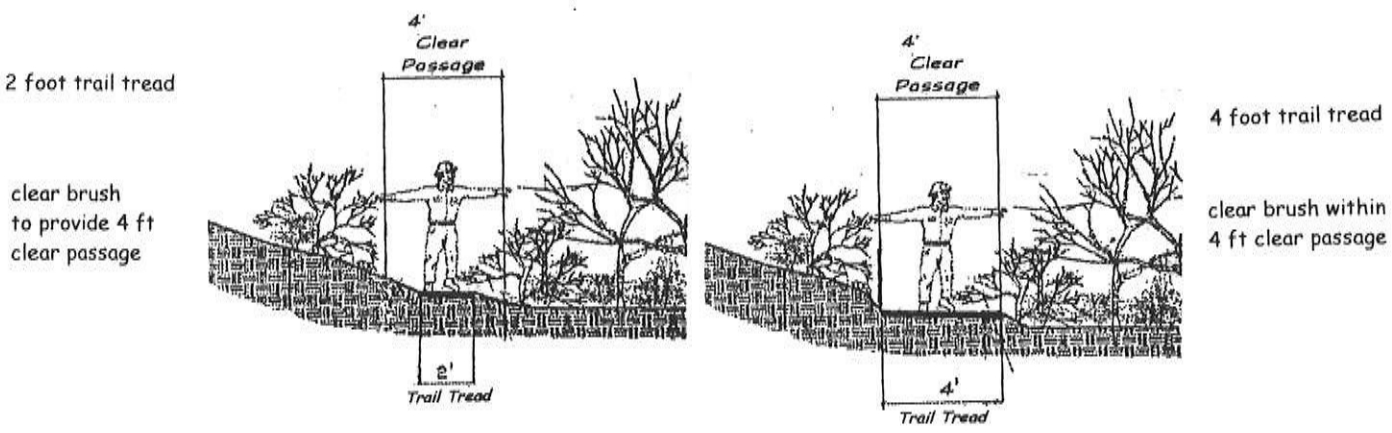
Dimensions: The standard clear passage width is 4 feet.

The trail tread within that 4 feet should be at least two feet wide and should not be more than four feet wide. Any trail tread within this range is acceptable and should not be widened or narrowed.

When the trail tread is less than four feet, brushing is done at the 3-8 foot level to provide the desired 4 feet of clear passage.

Under 3 feet small plants may grow on the trail tread. Plants that are harmful to hikers or hazardous should be removed to provide the 4 foot clear passage. Let other plants remain.

The trail is cleared to a height of 8 feet.



7. Glossary

7. Glossary

Abutment	The foundation of either extreme end of a bridge that supports the superstructure (sills, stringers, trusses, or decks).
ADA	Americans with Disabilities Act.
Allelopathic Soils	Soils containing a chemical compound produced by one plant species that interferes with the germination or growth of other plants. Plants responsible for allelopathic soils include California Bay and Eucalyptus.
Back slope	The cut bank formed by the excavation extending upward from the tread on the inside edge of the trail. A bank created by cutting into the side of the hill to make space for the trail bed. Also known as a cut slope.
Berm -	A mound or ridge of packed earth or rocks along on the outside of the trail bed, occurring either intentionally or unintentionally.
Borrow Sites	Areas from which soil, or gravel is excavated for use on a construction site.
Bridge	Structures used for crossing permanent and seasonal streams, dry ravines or gorges and other obstacles in an environmentally friendly manner.
Brushing	The removal of living or dead shrubs and tree branches that are within or overhanging onto the travelway as needed for the safety of the trail visitor, for resource protection or for the protection of the trail.
CalEPPC	California Exotic Pest Council.
CDFG	California Department of Fish and Game.
Chaparral	A shrubby vegetation type dominated by chamise, manzanita, ceanothus and other woody species, which occurs on dry slopes.
Cismontane Woodland	Woodland occurring west of the main crest of the Sierra Nevada Mountains.

Clearing Limits	The outer edges or a clearing area as shown drawings or explained in the text of Section 6.
Coniferous Forest	Woodland dominated by cone-bearing trees, such as pine, redwood, and cedar.
Cut Slope	See "Back slope."
Debris Flow	A rapidly moving, shallow slope failure of soil and surficial materials triggered by the accumulation of water (storm runoff) in the soil profile. Commonly known as a mudslide.
Decking	That part of the bridge structure that provides direct support for trail traffic.
Displays	Information indicating the characteristics of the trail, such as the trail grade, trail width, and the trail surface and any obstacles to travel.
Downed Trees	Those trees, which have fallen into and are obstructing the trail passageway.
Drain, Cross	A structure that moves runoff water off the side of the trail. Examples of cross drains are drainage dips, grade dips, and water bars.
Drainage	Refers to the movement of water either onto, across, under, along, or around the trail.
Drainage Dip	A shallow out-sloping ditch cut across the trail at an angle to divert water to the side.
Drainage, Surface	Water movement on the surface of the ground or a trail, typically caused by storm runoff
Dry Ravel	The particle by particle transport of loose soil down slope occurring on steep slopes with little or no herbaceous vegetation. It is caused by gravity and such factors as animal activity, wind, and thermal grain expansion. In Foothills Park dry ravel is known to occur in the Chaparral and Bay Woodland plant communities.

Duff	Organic matter (leaves, needles, twigs, etc.) on the surface of the ground, such as a mat of fallen leaves.
Endangered Species	Plant or animal species included on the state or federal list of endangered species and protected by the federal Endangered Species Act or the California Endangered Species Act.
Entrenched Trail	A trail that has experienced cupping, rutting or trenching into the trail tread resulting from trampling and/or water erosion.
Erosion	The detachment and removal of soil particles. The process of wearing away or gradually destroying by abrasion.
Grade Dip	A drainage structure created by developing a short segment of reverse grade in the overall trail grade on an ascending or descending hillside trail, accompanied by an out-sloped tread at the point of reverse grade. Grade dips are used to divert water off the trail that otherwise would run down the length of the trail.
Grade	The steepness of a slope or the trail tread as it ascends or descends. Often expressed as a percentage (feet change in elevation for every 100 feet measured in a horizontal plane)
Grade, Maximum	The steepest grade found on any part of a trail
Grade, Trail	The slope maintained by the trail in the direction of travel. It is measured in percentage (feet change in elevation for every 100 horizontal feet).
Gullying	A type of erosion caused by storm runoff water that erodes out channels (i.e. gullies) greater than one foot square in cross-section.
Inorganic Materials	May include mineral aggregates, such as different types of sand and gravel where soils are wet.
Leaners	Those trees that are leaning towards or into the trail corridor that could restrict access along the trail.
Middle Plane	Plants, typically chaparral or woody material species that mature at between 3 and 10 feet above the ground surface

Mixed Evergreen Forest	A vegetation type dominated by a variety of evergreen trees, including California bay laurel and coast live oak.
Montane Coniferous Forest	A vegetation type dominated by cone-bearing trees, located in the mountains.
Mulches, Organic	Materials such as wood chips made from plants that can be used to retard the sprouting of weeds or to increase a population of a tree species
Native Soil	The natural soil as it exists in place. The opposite of fill material.
Outer Edge	The edge of the trail bed that borders the downhill side of a hillside trail, also called the outside edge.
Outsloping	Sloping the trail tread so that it is lower on the outside or downhill side of the trail than it is on the inside or backside. Outsloping will allow water to flow off the trail without building up velocity.
Overhead Canopy	The vegetation that arches over the trail corridor providing shade for understory plants and a sense of enclosure for trail users
Pre-maintenance Construction Survey	Performing a physical examination of the project work site to evaluate solutions to trail deficiencies, select the appropriate course of action, formulate the design, and quantify the materials and equipment needed.
Pre-maintenance Biotic Surveys	Surveys that are conducted to verify that that either there are no sensitive species or to flag the sensitive area and/or reevaluate timing of work prior to commencing any maintenance activities to avoid impacting sensitive plant or animal species that are identified during the survey.
Renegade Trails	Trails that have developed by visitor usage off of the existing trail system without any planning or design.
Revegetation, Active	Actions ranging from transplanting on-site vegetation to importing genetically appropriate seed or propagated plants.
Revegetation, Passive	Allows for surrounding vegetation to recolonize the site.

Rills	Miniature channels (up to several inches deep) caused by the erosion of exposed soils by storm runoff. Rills often develop in parallel series and may coalesce into larger channels called gullies.
Rock Drain	An elevated section of trail, that usually is constructed across permanently or seasonally wet areas.
Run-out Track	The path taken by a debris flow as it moves, fluid-like from a higher elevation to a lower elevation. Structures within a run-out track are subject to damage or destruction during a debris flow event.
Scour Eddies	Water which moves vigorously contrary to the direction of the main current with abrasive force against a creek bank.
Sensitive Species	Any plant or animal species that is included on a list of species which are known or suspected to be declining in number. Such lists include (but are not limited to) those posted by the state or federal government for species that are endangered, threatened, protected, of concern, or fully protected, and the Inventory of Rare and Endangered Plants by the California Native Plant Society.
Serpentine	Soil type derived from ultramafic rock which has low nutrient value and often supports an assemblage of rare plant and insect species.
Side Slope	The slope of the hillside. Trails as they climb, cross the side slope of the hill. The slope to either side of a hillside trail.
Sidecast Material	Fill material that resides on or forms the hillside below the trail bed.
Slough Containment Wall	A 2-foot high wall built at the toe of the cut bank with space between it and the bank to catch and hold material that "sloughs" or falls off the face of the bank or slope above. To be effective, the captured soil needs to be periodically removed from behind the wall. It is not a retaining wall.
Sloughed Materials	Soil or organic matter that has eroded from the upper bank or slope onto the tread. Also known as slough (pronounced "sluff").
Switchback	A tight turn in a trail approaching 180 degrees. A technique used on steep hillsides to gain or lose elevation while maintaining a reasonable trail grade.

Take	Any action which may result in harassing harming, pursuing, hunting, shooting, wounding, killing, trapping capturing or collecting a federally listed, endangered species of wildlife or attempting to engage in such conduct. Federal regulations have broadened this definition to include significant habitat modification or degradation where it actually kills or significantly impairs essential behavioral patterns, including breeding, feeding or shelter (50 CFR Section 17.3). Such action taken without a permit is subject to criminal penalties under the Endangered Species Act.
Threatened Species	Plant or animal species included on the federal list of threatened species and protected by the federal Endangered Species Act.
Trail Bed	The primary excavated substrate of a trail upon which the tread or finished surface lies.
Trail Creep	A process in which is the trail surface is eroded and displaced slightly downhill along the outside (lower) edge causing the tread to become narrower.
Trail Maintenance Log	An inventory of physical features along or adjacent to the trail. An item by item record of trail features and facilities or improvements on a specific trail.
Trail Structures	The constructed, manmade elements within the trail corridor, which facilitate a safe, pleasant trail experience.
Trail Tread	The surface portion of a trail excluding the backslope and shoulder. The tread surface could include native material or compacted, crushed gravel surface.
Trailhead	The start or end of a trail often accompanied by various public facilities, such as directional and informational signs.
Ultramafic	An igneous rock type that contains ferromagnesian silicate mineral. Includes serpentinite, dunite and peridotite. Sometimes appears as a molten intrusive in Franciscan rock and sometimes as sill-like sheets.
Understory	Vegetation (usually shrubs and herbaceous plants) growing under a higher canopy (usually trees).

Universal Access	Trails designed to accommodate the needs of all individuals, including those who have limited mobility and/or skills.
Universal Trail Assessment	An assessment of trails to determine the level of accessibility that they provide. Factors that are considered include trail length, steepness, cross-slope, width, surface type, obstacles or other hazards. Information may be conveyed at trailheads with icon markers and/or on maps using a top view map, profile map, and obstacle locator key.
USFWS	United States Fish and Wildlife Service.
USGS	United States Geological Service.
Water Bar	An earthen berm and associated shallow ditch built diagonally across a trail for the purpose of diverting runoff water. Water bars are used at regular intervals along a trail in order to keep the speed, volume and distance water travels down the trail to a minimum.
Woody Shrubs	Woody plants that don't grow taller than 10 feet and often have more than one stem.

8. References & Contacts

8. References & Contacts

8.1 References

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8.2 Contacts

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Personal Communications

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Launer, Alan, Stanford University biologist, personal communication sensitive biotic species

Lozier, Lynn, Nature Conservancy, personal communication vegetation management techniques

Vandersteen, Yon, Private Trail Contractor with City of Palo Alto, personal communication mulching techniques to create a firebreak in chaparral vegetation

Woods, Del, Midpeninsula Regional Open Space District, personal communication trail design and maintenance standards

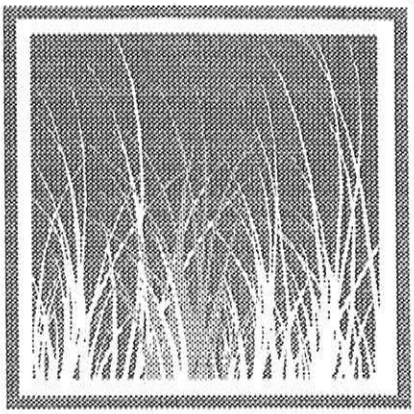
9. Appendices

Appendix A
Exotic Pest Plants of Greatest Ecological Concern in California

The CalEPPC List:

Exotic Pest Plants of Greatest Ecological Concern in California

October, 1999



The CalEPPC list is based on information submitted by our members and by land managers, botanists and researchers throughout the state, and on published sources. The list highlights non-native plants that are serious problems **in wildlands** (natural areas that support native ecosystems, including national, state and local parks, ecological reserves, wildlife areas, national forests, BLM lands, etc.).

List categories include:

List A: Most Invasive Wildland Pest Plants; documented as aggressive invaders that displace natives and disrupt natural habitats. Includes two sub-lists; List A-1: Widespread pests that are invasive in more than 3 Jepson regions (see page 3), and List A-2: Regional pests invasive in 3 or fewer Jepson regions.

List B: Wildland Pest Plants of Lesser Invasiveness; invasive pest plants that spread less rapidly and cause a lesser degree of habitat disruption; may be widespread or regional.

Red Alert: Pest plants with potential to spread explosively; infestations currently small or localized. If found, alert CalEPPC, County Agricultural Commissioner or California Department of Food and Agriculture.

Need More Information: Plants for which current information does not adequately describe nature of threat to wildlands, distribution or invasiveness. Further information is requested from knowledgeable observers.

Annual Grasses: New in this edition; a preliminary list of annual grasses, abundant and widespread in California, that pose significant threats to wildlands. Information is requested to support further definition of this category in next List edition.

Considered But Not Listed: Plants that, after review of status, do not appear to pose a significant threat to wildlands.

Plants that fall into the following categories are not included in the List:

- Plants found mainly or solely in disturbed areas, such as roadsides and agricultural fields.
- Plants that are established only sparingly, with minimal impact on natural habitats.

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The CalEPPC list is updated regularly. Please use the form provided to send comments, suggestions or new information to: **Peter Warner, 555 Magnolia Avenue, Petaluma, CA, 94952-2080**, or via email at **peterjwarner@earthlink.net**

Thanks to all those who submitted comments for the 1999 list.

List A-1: Most Invasive Wildland Pest Plants; Widespread

Latin Name[1]	Common Name	Habitats of Concern and Other Comments	Distribution[2]
Ammophila arenaria	European beach grass	Coastal dunes	SCo,CCo,NCo
Arundo donax	giant reed, arundo	Riparian areas	cSNF,CCo,SCo,SnGb,D,GV
Bromus tectorum	cheat grass, downy brome	Sagebrush, pinyon-juniper, other desert communities; increases fire frequency	GB,D
Carpobrotus edulis	iceplant, sea fig	Many coastal communities, esp. dunes	SCo,CCo,NCo,SnFrB
Centaurea solstitialis[C]	yellow starthistle	Grasslands	CA-FP (uncommon in SoCal)
Cortaderia jubata	Andean pampas grass, jubatagrass	Horticultural; many coastal habitats, esp. disturbed or exposed sites incl. logged areas	NCo,NCoRO,SnFrB, CCo,WTR,SCo
Cortaderia selloana	pampas grass	Horticultural; coastal dunes, coastal scrub, Monterey pine forest, riparian, grasslands; wetlands in ScV; also on serpentine	SnFrB,SCo,CCo,ScV
Cynara cardunculus[B]	artichoke thistle	Coastal grasslands	CA-FP, esp. CCo,SCo
Cytisus scoparius[C]	Scotch broom	Horticultural; coastal scrub, oak woodlands, Sierra foothills	NW,CaRF,SNF,GV, SCo,CW
Eucalyptus globulus	Tasmanian blue gum	Riparian areas, grasslands, moist slopes	NCoRO,GV,SnFrB, CCo,SCoRO,SCo,nChl
Foeniculum vulgare	wild fennel	Grasslands; esp. SoCal, Channel Is.; the cultivated garden herb is not invasive	CA-FP
Genista monspessulana[C]	French broom	Horticultural; coastal scrub, oak woodlands, grasslands	NCoRO,NCoRI,SnFrB, CCo,SCoRO,sChl,WTR,PR
Lepidium latifolium[B]	perennial pepperweed, tall whitetop	Coastal, inland marshes, riparian areas, wetlands, grasslands; potential to invade montane wetlands	CA (except KR,D)
Myriophyllum spicatum	Eurasian watermilfoil	Horticultural; lakes, ponds, streams, aquaculture	SnFrB,SnJV,SNH(?); prob. CA
Pennisetum setaceum	fountain grass	Horticultural; grasslands, dunes, desert canyons; roadsides	Deltaic GV,CCo,SCo, SnFrB
Rubus discolor	Himalayan blackberry	Riparian areas, marshes, oak woodlands	CA-FP
Senecio mikanioides (=*Delairea odorata*)	Cape ivy, German ivy	Coastal, riparian areas, also SoCal (south side San Gabriel Mtns.)	SCo,CCo,NCo,SnFrB,SW
Taeniatherum caput-medusae[C]	medusa head	Grasslands, particularly alkaline and poorly drained areas	NCoR,CaR,SNF,GV,SCo
Tamarix chinensis, T. gallica, T. parviflora & T. ramosissima	tamarisk, salt cedar	Desert washes, riparian areas, seeps and springs	SCo,D,SnFrB,GV,sNCoR, sSNF,Teh,SCoRI,SNE, WTR
Ulex europaeus[B]	gorse	North, central coastal scrub, grasslands	NCo,NCoRO,CaRF, n&cSNF,SnFrB,CCo

[1]Noxious Weed Ratings

F: Federal Noxious Weed, as designated by the USDA; targeted for federally-funded prevention, eradication or containment efforts.

A: CA Dept. of Food & Agriculture, on "A" list of Noxious Weeds; agency policies call for eradication, containment or entry refusal.

B: CA Dept. of Food & Agriculture, on "B" list of Noxious Weeds; includes species that are more widespread, and therefore more difficult to contain; agency allows county Agricultural Commissioners to decide if local eradication or containment is warranted.

C: CA Dept. of Food & Agriculture, on "C" list of Noxious Weeds; includes weeds that are so widespread that the agency does not endorse state or county-funded eradication or containment efforts except in nurseries or seed lots.

Q: CA Dept. of Food & Agriculture's designation for temporary "A" rating pending determination of a permanent rating.

For most species nomenclature follows *The Jepson Manual: Higher Plants of California* (Hickman, J., Ed., 1993).

List A-2: Most Invasive Wildland Pest Plants; Regional

Latin Name[1]	Common Name	Habitats of Concern and Other Comments	Distribution[2]
Ailanthus altissima	tree of heaven	Riparian areas, grasslands, oak woodlands, esp. GV, SCo	CA-FP
Atriplex semibaccata	Australian saltbush	SoCal, coastal grasslands, scrub, "high marsh" of coastal salt marshes	CA (except CaR,c&sSN)
Brassica tournefortii	Moroccan or African mustard	Washes, alkaline flats, disturbed areas in Sonoran Desert	SW,D
Bromus madritensis ssp. *rubens*	red brome	Widespread; contributing to SoCal scrub, desert scrub type conversions; increases fire frequency	CA
Cardaria draba[B]	white-top, hoary cress	Riparian areas, marshes of central coast; also ag. lands, disturbed areas	Problem only in CCo
Conicosia pugioniformis	narrow-leaved iceplant, roundleaf iceplant	Coastal dunes, sandy soils near coast; best documented in San Luis Obispo and Santa Barbara cos.	CCo
Cotoneaster pannosus, *C. lacteus*	cotoneaster	Horticultural; many coastal communities; esp. North Coast, Big Sur; related species also invasive	CCo,SnFrB,NW
Cytisus striatus	striated broom	Often confused with C. scoparius; coastal scrub, grassland	SnFrB,CCo,SCo,PR
Egeria densa	Brazilian waterweed	Streams, ponds, sloughs, lakes; Sacramento-San Joaquin Delta	n&sSNF,SnJV,SnFrB, SnJt,SNE
Ehrharta calycina	veldt grass	Sandy soils, esp. dunes; rapidly spreading on central coast	CCo,SCoRO,WTR
Eichhornia crassipes	water hyacinth	Horticultural; established in natural waterways, esp. troublesome in Sacramento-San Joaquin Delta	GV,SnFrB,SCo,PR
Elaeagnus angustifolia	Russian olive	Horticultural; interior riparian areas	SnJV,SnFrB,SNE,DMoj
Euphorbia esula[A]	leafy spurge	Rangelands in far no. CA, also reported from Los Angeles Co.	eKR,NCo,CaR,MP,SCo
Ficus carica	edible fig	Horticultural; Central Valley, foothill, South Coast and Channel Is. riparian woodlands	nSNF,GV,SnFrB,SCo
Lupinus arboreus	bush lupine	Native to SCo, CCo; invasive only in North Coast dunes	SCo,CCo,NCo
Mentha pulegium	pennyroyal	Santa Rosa Plain (Sonoma Co.) and Central Valley vernal pools; wetlands elsewhere	NW,GV,CWSCo
Myoporum laetum	myoporum	Horticultural; coastal riparian areas in SCo	SCo,CCo
Saponaria officinalis	bouncing bet	Horticultural; meadows, riparian habitat in SNE, esp. Mono Basin	NW,CaRH,nSNF,SnFrB, SCoRO,SCo,PR,MP,SNE, GV
Spartina alterniflora	Atlantic or smooth cordgrass	S.F. Bay salt marshes; populations in Humboldt Bay believed extirpated	CCo(shores of S.F. Bay)

[2]Distribution by geographic subdivisions per the Jepson Manual

CA=California
CA-FP=California Floristic Province
CaR=Cascade Ranges
CaRF=Cascade Range Foothills
CCo=Central Coast
ChI=Channel Islands
CW=Central Western CA
D=Deserts
DMoj=Mojave Desert
DSon=Sonoran Desert
GB=Great Basin
GV=Great Valley
KR=Klamath Ranges
MP=Modoc Plateau
NCo=North Coast
NCoRI=Inner NCo Ranges
NCoRO=Outer NCo Ranges
NW=Northwestern CA
PR=Peninsular Ranges
SCo=South Coast
SCoRI=Inner SCo Ranges
SCoRO=Outer SCo Ranges
ScV=Sacramento Valley
SnJV=San Joaquin Valley
SN=Sierra Nevada
SNE=East of SN
SNF=SN Foothills
SNH=High SN
SnFrB=San Francisco Bay Area
SnGb=San Gabriel Mtns
SW=Southwestern CA
Teh=Tehachapi Mtns
WTR=Western Transverse Ranges

List B: Wildland Pest Plants of Lesser Invasiveness

Latin Name[1]	Common Name	Habitats of Concern and Other Comments	Distribution[2]
Ageratina adenophora[F]	eupatory	Horticultural; coastal canyons, coastal scrub, slopes, Marin to San Diego Co; San Gabriel Mtns.	CCo,SnFrB,SCo,SCoRO
Bassia hyssopifolia	bassia	Alkaline habitats	CA (except NW,SNH)
Bellardia trixago	bellardia	Grasslands, on serpentine, where a threat to rare natives	NCoRO,CCo,SnFrB
Brassica nigra	black mustard	Coastal communities, esp. fog-belt grasslands; disturbed areas	CA-FP
Cardaria chalepensis[B]	lens-podded white-top	Wetlands of Central Valley	CA
Carduus pycnocephalus[C]	Italian thistle	Grasslands, shrublands, oak woodlands	sNCo,sNCoR,SNF,CW, SCo,ScV
Centaurea calcitrapa[B]	purple starthistle	Grasslands	NW,sCaRF,SNF,GV,CW,SW
Centaurea melitensis	tocalote, Malta starthistle	Widespread; sometimes misidentified as C. solstitialis; perhaps a more serious invader than currently recognized	CA-FP,D
Cirsium arvense[B]	Canada thistle	Especially troublesome in riparian areas	CA-FP
Cirsium vulgare	bull thistle	Riparian areas, marshes, meadows	CA-FP,GB
Conium maculatum	poison hemlock	Mainly disturbed areas but may invade wildlands; known to poison wildlife; early expanding stage in many areas, esp. San Diego Co. riparian, oak understory	CA-FP
Crataegus monogyna	hawthorn	Horticultural; recent invader, colonizing healthy native forest around Crystal Springs reservoir on S.F. peninsula	SnFrB,CCo,NCo,NCoR
Ehrharta erecta	veldt grass	Wetlands, moist wildlands; common in urban areas; potential to spread rapidly in coastal, riparian, grassland habitats	SnFrB,CCo,SCo
Erechtites glomerata, E. minima	Australian fireweed	Coastal woodlands, scrub, NW forests, esp. redwoods	NCo,NCoRO,CCo,SnFrB, SCoRO
Festuca arundinacea	tall fescue	Horticultural (turf grass); coastal scrub, grasslands in NCo, CCo	CA-FP
Hedera helix	English ivy	Horticultural; invasive in coastal forests, riparian areas	CA-FP
Holcus lanatus	velvet grass	Coastal grasslands, wetlands in No. CA	CA exc. DSon
Hypericum perforatum[C]	Klamathweed, St. John's wort	Redwood forests, meadows, woodlands; invasion may occur due to lag in control by established biocontrol agents	NW,CaRH,n&cSN,ScV, CCo,SnFrB,PR
Ilex aquifolium	English holly	Horticultural; coastal forests, riparian areas	NCoRO,SnFrB,CCo
Iris pseudacorus	yellow water iris, yellow flag	Horticultural; riparian, wetland areas, esp. San Diego, Los Angeles cos.	SnFrB,CCo,sSnJV,SCo
Leucanthemum vulgare	ox-eye daisy	Horticultural; invades grassland, coastal scrub	KR,NCoRO,n&cSNH, SnFrB,WTR,PR
Mesembryanthemum crystallinum	crystalline iceplant	Coastal bluffs, dunes, scrub, grasslands; concentrates salt in soil	NCo,CCo,SCo,ChI
Myriophyllum aquaticum	parrot's feather	Horticultural; streams, lakes, ponds	NCo,CaRF,CW,SCo
Olea europaea	olive	Horticultural and agricultural; reported as invasive in riparian habitats in Santa Barbara, San Diego	NCoR,NCoRO,CCo, SnFrB,SCoRO,SCo
Phalaris aquatica	Harding grass	Coastal sites, esp. moist soils	NW,cSNF,CCo,SCo
Potamogeton crispus	curlyleaf pondweed	Scattered distribution in ponds, lakes, streams	NCoR,GV,CCo,SnFrB, SCo,ChI,SnGb,SnBr,DMoj
Ricinus communis	castor bean	SoCal coastal riparian habitats	GV,SCo,CCo
Robinia pseudoacacia	black locust	Horticultural; riparian areas, canyons; native to eastern U.S.	CA-FP,GB
Schinus molle	Peruvian pepper tree	Horticultural; invasive in riparian habitats in San Diego, Santa Cruz Is.	SNF,GV,CW,SW,Teh

List B: Continued

Latin Name[1]	Common Name	Habitats of Concern and Other Comments	Distribution[2]
Schinus terebinthifolius	Brazilian pepper	Horticultural; riparian areas	sSCo
Senecio jacobaea[B]	tansy ragwort	Grasslands; biocontrol agents established	NCo,wKR,s&wCaR, nSNF, nScV,SW
Spartium junceum	Spanish broom	Coastal scrub, grassland, wetlands, oak woodland, NW forests, esp. redwoods; also roadcuts	NCoRO,ScV,SnFrB, SCoRO,SCo,sChI,WTR
Verbascum thapsus	woolly or common mullein	SNE meadows, sagebrush, pinyon-juniper woodlands; shores of Boggs Lake (Lake Co.)	CA
Vinca major	periwinkle	Horticultural; riparian, oak woodland, other coastal habitats	NCoRO,SnFrB, CCo, sSCoRO,SCo

Red Alert: Species with potential to spread explosively; infestations currently restricted

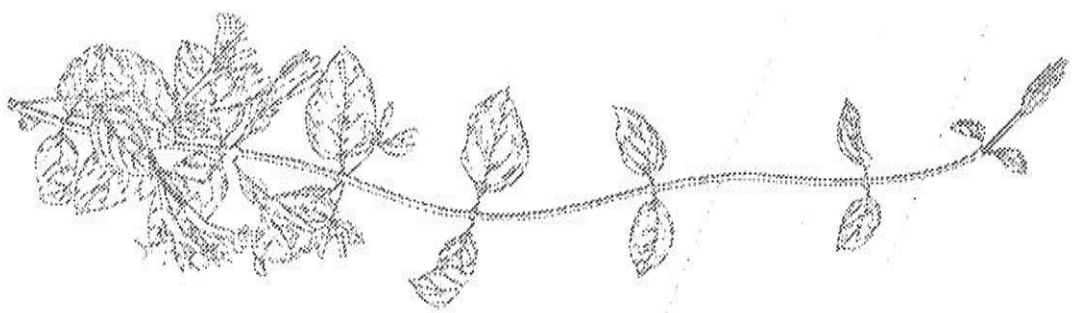
Latin Name[1]	Common Name	Habitats of Concern and Other Comments	Distribution[2]
Alhagi pseudalhagi[A]	camel thorn	Noxious weed of arid areas; most infestations in California have been eradicated	GV,sSNE,D
Arctotheca calendula[A]	Capeweed	Seed-producing types are the problem; most are vegetative only	NCo,SnFrB,CCo
Centaurea maculosa[A]	spotted knapweed	Riparian, grassland, wet meadows, forest habitats; contact CA Food & Ag if new occurrences found	CaR,SN,nScV,nCW,MP, nSNE,sPR,NW
Crupina vulgaris[F,A]	bearded creeper, common crupina	Aggressively moving into wildlands, esp. grassland habitats	NCoR (Sonoma Co.),MP
Halogeton glomeratus[A]	halogeton	Noxious weed of Great Basin rangelands; report locations to CA Food & Ag; goal is exclusion from CA	GB
Helichrysum petiolare	licorice plant	North coastal scrub; one population on Mt. Tamalpais, w. Marin Co.	Not in Jepson
Hydrilla verticillata[F,A]	hydrilla	Noxious water weed; report locations to CA Food & Ag; eradication program in place; found in Clear Lake (Lake Co.) in 1994	NCoRI,n&cSNF,ScV,SCo,D
Lythrum salicaria[B]	purple loosestrife	Horticultural; noxious weed of wetlands, riparian areas	sNCo,NCoRO,nSNF,ScV, SnFrB,nwMP
Ononis alopecuroides[Q]	foxtail restharrow	Eradication efforts underway in San Luis Obispo Co.; to be looked for elsewhere in CA	CCo; not in Jepson
Retama monosperma	bridal broom	First noted at Fallbrook Naval Weapons Station, San Diego Co; could rival other invasive brooms	San Diego Co.; not in Jepson
Salvinia molesta[F]	giant waterfern	Ponds, lakes, reservoirs, canals	Napa, Sonoma cos., lower Colorado River; not in Jepson
Sapium sebiferum	Chinese tallow tree	Horticultural; riparian, wetland habitats, open areas and understory	ScV,SnFrB; not in Jepson
Sesbania punicea	scarlet wisteria tree	Horticultural; riparian areas; American River Parkway, Sacramento Co., Suisun Marsh, San Joaquin River Parkway	ScV,SnJV; not in Jepson
Spartina anglica	cord grass	Scattered in S.F. Bay	Not in Jepson
Spartina densiflora	dense-flowered cord grass	Scattered in S.F. Bay, Humboldt Bay salt marshes	CCo,NCo
Spartina patens	salt-meadow cord grass	One site in S.F. Bay, also Siuslaw Estuary, OR and Puget Sound, WA	CCo

Need More Information

Latin Name[1]	Common Name	Habitats of Concern and Other Comments	Distribution[2]
Acacia dealbata	silver wattle	Aggressive in natural areas?	SnFRB,SCoRO,SCoRI,CCo
Acacia decurrens	green wattle	Sometimes confused with A. dealbata; aggressive in natural areas?	Unknown
Acacia melanoxylon	blackwood acacia	Reported from S.F. Bay area, central coast, Santa Cruz Is.; spreads slowly; other areas?	SnFrB,SCoRO,SCo,CCo
Aeschynomene rudis[B]	rough jointvetch	Princeton area, Colusa Co.; pest of rice crops; potential threat to riparian, wetland habitats?	ScV
Agrostis avenacea	Pacific bentgrass	Invading vernal pools in San Diego area; attempts at manual eradication unsuccessful so far; problem in other areas?	sNCo,sNCoR,SNF, GV,CW,nSCo
Aptenia cordifolia	red apple	Habitats where invasive?	CCo,SCo,sChl
Asphodelus fistulosus	asphodel	Common in SCo highway rights-of-way, other disturbed sites; threats to wildlands?	sSnJV,SCo
Carduus acanthoides[A]	giant plumeless thistle	Threatens wildlands?	NCoRI,nSN,SnFrB, nSCoRO,MP
Cistus ladanifer	gum cistus	Horticultural; invades coastal sage scrub, chaparral; areas where problematic?	sCCo,SnGb
Cordyline australis	New Zealand cabbage	Infestation at Salt Point State Park; bird-dispersed; other problem areas?	Not in Jepson
Cotoneaster spp. (exc. C. pannosus, C. lacteus)	cotoneaster	Horticultural; bird-distributed; which species are problems in wildlands?	Unknown
Cupressus macrocarpa	Monterey cypress	Native only to Monterey Peninsula; planted and naturalized CCo, NCo; threat to wildlands?	CCo
Descurainia sophia	flixweed, tansy mustard	Entering Mojave wildlands through washes; threat to wildlands?	CA
Dimorphotheca sinuata	African daisy, Cape marigold	Horticultural; reported as invasive in w. Riverside Co., Ventura Co.; problem elsewhere?	SnJV,SCoRO,SCo,PR
Echium candicans, E. pininana	pride of Madeira, pride of Teneriffe	Horticultural; riparian, grassland, coastal scrub communities; spreads by seed	CCo,SnFrB,SCo,sNCo
Ehrharta longiflora	veldt grass	Reported from San Diego	Not in Jepson
Erica lusitanica	heath	Threat to wildlands?	NCo (Humboldt Co.)
Euphorbia lathyris	caper spurge, gopher plant	Invades coastal scrub, marshes, dunes; Sonoma, Marin cos.; threat to wildlands?	NCo,CCo,GV,SCo
Gazania linearis	gazania	Horticultural; invades grassland in S.F., coastal scrub?	CCo,SCo
Glyceria declinata		Although reported from Central Valley vernal pools, genetic research is needed to confirm identity; plants that have been called G. declinata key in Jepson to native G. occidentalis	Uncertain; not in Jepson
Hedera canariensis	Algerian ivy	Horticultural; invasive in riparian areas in SoCal?	Not in Jepson
Hirschfeldia incana	Mediterranean or short-pod mustard	Increasing in western, southern Mojave; threat to wildlands?	NCo,SNF,GV,CW,SCo, DMoj
Hypericum canariense	Canary Island hypericum	Reported in San Diego area, coastal sage scrub, grassland; threat to wildlands?	SCo
Hypochaeris radicata	rough cat's ear	Widespread in coastal grasslands, wetlands; threat to wildlands?	NW,CaRF,nSNF,ScV, CW,SCo
Isatis tinctoria[B]	dyers' woad	Well-known invader in Utah; threat to wildlands?	KR,CaR,nSNH,MP
Ligustrum lucidum	glossy privet	Horticultural; spreading rapidly on Mendocino coast; problem in other areas?	NCo; not in Jepson
Limonium ramosissimum ssp. provinciale	sea lavender	Reported spreading in Carpinteria Salt Marsh; problem in other areas?	Not in Jepson

Need More Information: Continued

Latin Name[1]	Common Name	Habitats of Concern and Other Comments	Distribution[2]
Ludwigia uruguayensis (= *L. hexapetala*)	water primrose	Invasive in aquatic habitats; non-native status questioned?	NCo,sNCoRO,CCo, SnFrB,SCo
Malephora crocea	ice plant	Invades margins of wetlands, bluffs along SCo	CCo,SCo,sChl
Maytenus boaria	mayten	Horticultural; scattered in riparian forests, ScV; east SnFrB	ScV,SnFrB
Mesembryanthemum nodiflorum	slender-leaved iceplant	Abundant on Channel Islands; invades wetlands; habitats where problematic?	SnFrB,SCo,Chl
Nicotiana glauca	tree tobacco	Disturbed places; not very competitive with natives in coastal scrub, chaparral; spreading along Putah Creek (Yolo Co.); problems elsewhere?	NCoRI,c&sSNF, GV,CW,SW,D
Oxalis pes caprae	Bermuda buttercup	Invades disturbed sites; invasive in undisturbed habitats?	NCo,NCoRO,CCo, SnFrB,SCoRO,SCo
Parentucellia viscosa		Threat to NCo (Humboldt Co.) dune swales?	NCo,NCoRO,CCo,SCo
Passiflora caerulea		Horticultural; reported from SoCal; threat to wildlands?	SCo; not in Jepson
Pennisetum clandestinum[F,C]	Kikuyu grass	Disturbed sites, roadsides; threat to wildlands?	NCo,CCo,SnFrB,SCo, Santa Cruz Is.
Phyla nodiflora	mat lippia	Most varieties in CA are native; taxonomy unclear; status of plants in vernal pools, wetlands?	NW(except KR,NCoRH), GV,CCo,SnFrB,SCo, PR,DSon
Pinus radiata cultivars	Monterey pine	Cultivars invading native Monterey, Cambria forests, where spread of pine pitch canker is a concern	CCo
Piptatherum miliaceum	smilo grass	Aggressive in SoCal creeks, canyons; threats to wildlands?	NCo,GV,CW,SCo
Pistacia chinensis	Chinese pistache	Horticultural; invades riparian areas and woodlands in ScV	ScV
Prunus cerasifera	cherry plum	Oak woodland, riparian areas; esp. Marin, Sonoma cos.; bird-distributed; problems elsewhere?	SnFrB,CCo
Pyracantha angustifolia	pyracantha	Horticultural; spreads from seed in S.F. Bay area; bird-distributed; problem elsewhere?	sNCoRO,CCo,SnFrB, SCo
Salsola soda	glasswort	Threat to salt marshes?	nCCo,SnFrB
Salsola tragus[C]	Russian thistle, tumbleweed	Abundant in dry open areas in w. Mojave Desert, Great Basin; not limited to disturbed sites; threats?	CA
Salvia aethiopis[B]	Mediterranean sage	Creates monocultures in E. Oregon grasslands; threat to CA wildlands?	MP
Stipa capensis		Distribution and threats?	Not in Jepson
Tamarix aphylla	athel	Spreading in Salton Sea area; threats to wildlands?	nSnJV,nSCo,D
Tanacetum vulgare	common tansy	Jepson reports as uncommon, escape from cultivation in urban areas; problem in wildlands?	NCo,NCoRO,CaRH, SCoRO
Verbena bonariensis, *V. litoralis*	tall vervain	Horticultural; invades riparian forests, wetlands; extensive along ScV riparian corridors; roadsides (Yuba Co.); elsewhere?	ScV,nSnJV,nSnFrB,CCo



Annual Grasses

Latin Name[1]	Common Name	Habitats of Concern and Other Comments	Distribution[2]
Aegilops triuncialis[B]	barbed goatgrass	Serpentine soils, grasslands	sNCoR,CaRF, n&cSNF, ScV,nCW
Avena barbata	slender wild oat	Lower elev. in SoCal; coastal slopes, coastal sage scrub, disturbed sites	CA-FP,MP,DMoj
Avena fatua	wild oat	Lower elev. in SoCal; coastal slopes, coastal sage scrub on deeper soil, disturbed sites	CA-FP,MP,DMoj
Brachypodium distachyon	false brome	Expanding in SoCal; common in Orange Co.	sNCoR,sCaRF, SNF,GV,CW,SCo,sChl
Bromus diandrus	ripgut brome	Coastal dunes, coastal sage scrub, grasslands	CA
Lolium multiflorum	Italian ryegrass	Wetland areas, esp. vernal pools in San Diego Co.; common in disturbed sites	CA-FP
Schismus arabicus	Mediterranean grass	Threat to Mojave and Colorado desert shrublands?	SnJV,CW,sChl,D
Schismus barbatus	Mediterranean grass	Threat to Mojave and Colorado desert shrublands?	SnJV,SW,D

Considered, but not listed

Latin Name[1]	Common Name	Habitats of Concern and Other Comments
Albizia lophantha	plume acacia	Not invasive
Anthoxanthum odoratum	sweet vernal grass	Disturbed sites on coast; Marin, Sonoma, Mendocino cos.
Carpobrotus chilensis	sea fig	Native status in question; not a threat to wildlands
Centranthus ruber	red valerian	Horticultural; roadcuts in Marin Co.; not a threat to wildlands
Convolvulus arvensis[C]	field bindweed	Disturbed sites; ag lands
Coprosma repens	mirror plant	No evidence of wildland threat
Crocosmia x crocosmiiflora		Generally in disturbed coastal, urban areas, roadsides
Digitalis purpurea	foxglove	Horticultural; scattered in prairies, meadows, disturbed sites; not a major wildland threat
Dipsacus sativus, D. fullonum	wild teasel, Fuller's teasel	Roadsides, disturbed sites
Fumaria officinalis, F. parviflora	fumitory	S.F. Bay area, Monterey Bay salt marshes, sandy disturbed sites
Medicago polymorpha	California bur clover	Grasslands, moist sites; mainly restricted to disturbed sites
Melilotus officinalis	yellow sweet clover	Restricted to disturbed sites in CA
Nerium oleander	oleander	Horticultural; not invasive, although reported from riparian areas in Central Valley, San Bernardino Mtns.
Picris echioides	bristly ox-tongue	Disturbed areas
Silybum marianum	milk thistle	Disturbed areas, especially overgrazed moist pasturelands; may interfere with restoration
Xanthium spinosum	spiny cocklebur	Identified as native in *The Jepson Manual* (Hickman, 1993) and *A California Flora* (Munz and Keck, 1968); restricted to disturbed areas
Zantedeschia aethiopica	calla lily	Horticultural; mainly a garden escape in wet coastal areas
Zoysia cultivars	Amazoy and others	Horticultural; no evidence of wildland threat

Request for Information: Exotic Pest Plants of Greatest Ecological Concern in CA

Please use this form to propose adding a new plant to the CalEPPC list or to provide other comments. Please provide as much detail as possible. Use the second side of this form or attach additional sheets if more space is needed. Please mail completed form to: **Peter Warner, 555 Magnolia Avenue, Petaluma, CA, 94952-2080**. Comments can be submitted by email to **peterjwarner@earthlink.net**

Species Name: _____

Does this weed displace healthy native communities, or
is it mainly restricted to disturbed sites like roadsides, agricultural areas, etc.? _____

_____

In which region(s) of California does this weed infest wildlands?
Indicate county(ies) and/or Jepson regions (see page 3). _____

_____

Which native communities does it infest? _____

List any rare plants, animals or communities threatened by this weed: _____

_____

How does it spread? (Seeds carried by wind, birds, other animals; vegetative runners?) _____

_____

Is this plant a recent invader of California wildlands? Ideas about how it got here? _____

_____

Is this plant sold by nurseries, or used in landscaping, restoration
or other activities that might lead to its further spread in wildlands? _____

_____

Describe any techniques that have been used to eradicate this plant.
Have they been successful? If not, why is the plant difficult to eradicate? _____

_____

Other comments? _____

_____

_____

_____

Name: _____ Affiliation: _____

Address: _____ City: _____ State: _____ Zip: _____

Phone: _____ FAX: _____ email: _____

Appendix B
Appendix B - Pathogens – Sudden Oak Death

During the past few years, numerous reports have appeared on the inexplicable death of tens of thousands of Tan Oak (Lithocarpus densiflorus), Coast Live Oak (Quercus agrifolia), California Black Oak (Quercus kelloggii), Shreve Oak (Quercus parvula var. shrevei) and Pacific Madrone (Arbutus menziesii) in and around Marin County. Dubbed Sudden Oak Death because of the apparent swiftness with which it kills oak trees, the pathogen responsible has now been identified and named

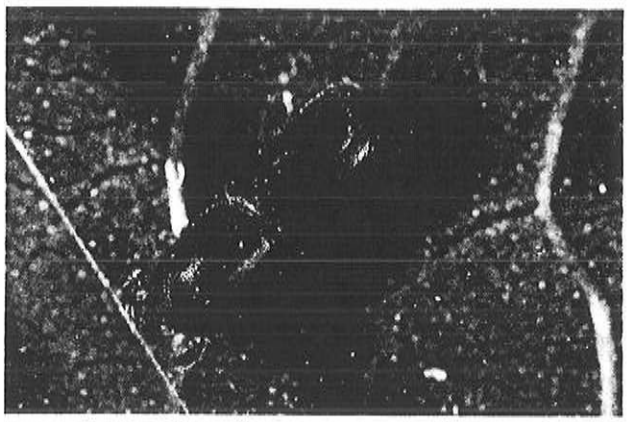
Phytophthora ramorum.

Sudden Death Threatens Oaks

by Jerrie Beard

During the past few years, numerous reports have appeared on the inexplicable death of tens of thousands of Tan Oak (Lithocarpus densiflorus), Coast Live Oak (Quercus agrifolia), California Black Oak (Quercus kelloggii), Shreve Oak (Quercus parvula var. shrevei) and Pacific Madrone (Arbutus menziesii) in and around Marin County. Dubbed Sudden Oak Death because of the apparent swiftness with which it kills oak trees, the pathogen responsible has now been identified and named Phytophthora ramorum.

First described in the early 1990's on Rhododendrons and Viburnum in Germany and the Netherlands, Sudden Oak Death was discovered in California on Tan Oaks in 1995. While distribution of the disease remains patchy, it has now been confirmed in 10 California counties — from Monterey to Sonoma — and as far north as Brookings, Oregon.



Task Force Heads Up Efforts

The California Oak Mortality Task Force was founded in August of 2000 to research, monitor and seek controls for the disease. Comprised of public agencies, non-profit organizations and private interests, the group acts as a point of contact for the legislature and as a coordinating entity for all research and activities related to Sudden Oak Death.

The task force is continually monitoring infected and healthy trees in affected areas to determine how the disease is diffused — whether by wind, rain, water, birds and animals, and/or humans — and how to control the spread. In addition, they hope to determine the short and long term impact of the disease on California's woodlands, assess future fire risk in affected forests, and reduce hazards presented by dead trees.

During the Fifth Symposium on Oak Woodlands, held in San Diego, California, October 22-25, researchers from UC Berkeley, UC Davis, UC Cooperative Extension, Cal Poly San Luis Obispo and Phytosphere Research presented the following information regasrding recent findings on the disease, its distribution and possible controls.

Current Distribution

The range of Sudden Oak Death continues to grow, with 10 California counties now known to be infected. While Marin and Santa Cruz counties have the highest incidence of the disease, Monterey, Napa, San Mateo, Santa Clara, Sonoma, Mendocino, Alameda and Solano counties are also afflicted. With new cases discovered regularly, the total distribution of the pathogen may be much greater.

Currently, it is difficult for researchers to determine the progression of the disease as they are still defining a baseline. However, based on research presented by Brice A. McPherson, Center of Forestry, Department of Environmental Sciences at UC Berkeley, infection levels in plot areas in Marin County have risen up to 15 percent over the past year. In March 2001, 38 percent of the Coast Live Oaks, 27 percent of California Black Oaks, and up to 55 percent of the Tan Oaks in the plot areas exhibited signs of the disease. Tan Oaks appear to be the least resistant and exhibited the largest increase in infection levels.

In Marin and Santa Cruz counties, P. ramorum is widespread in redwood forests with Tan Oak in the under story, and in mixed hardwood forests of oaks, Bay Laurel, Madrone and other species. It is also found in microclimates in urban areas on several ornamental varieties.

Researchers have discovered that afflicted areas are linked by hosts other than oaks. The distribution of the disease on these secondary hosts is more widespread than on oaks. According to David M. Rizzo, Department of Plant Pathology at UC Davis, and Matteo Garbelotto, Department of Environmental Sciences, Ecosystems Science Division at UC Berkeley, the list of hosts continues to expand at a rate of one new species every two weeks. Currently the list includes:

- Huckleberry (Vaccinium ovatum)
- California Buckeye (Aesculus californica)
- Big Leaf Maple (Acer macrophyllum)
- Pacific Madrone (Arbutus menziessii)
- California Bay Laurel (Umbellularia californica)
- California Buckeye (Aesculus californica)
- Rhododendron species
- Manzanita (Arctostaphylos manzanita)

Symptoms and mortality rates differ with each host. To date, the pathogen has been linked to tree mortality only in oaks from the red oak family and the related Tan Oak and Madrone. In other hosts, including California Bay Laurel, rhododendrons, and huckleberry, the disease causes only leaf spots and twig die back. Garbelotto noted, however, that these leaf spots are the major source of spores, which spread the disease, and speculated that these non-oak hosts are driving the disease forward.

While the list of affected species continues to grow, many appear to be resistant to P. ramorum. Researchers hope to find a control for the disease by studying these apparently immune species.

Environmental Risk Factors

Environmental factors that have been found to increase the risk of infection by P. ramorum include:

- Greater canopy exposure.
- Trees with many sprouts or trunks.
- Trees weakened by other pathogens.
- Spatial aggregation — infections tend to be localized.
- Bay Laurel growing in the area.

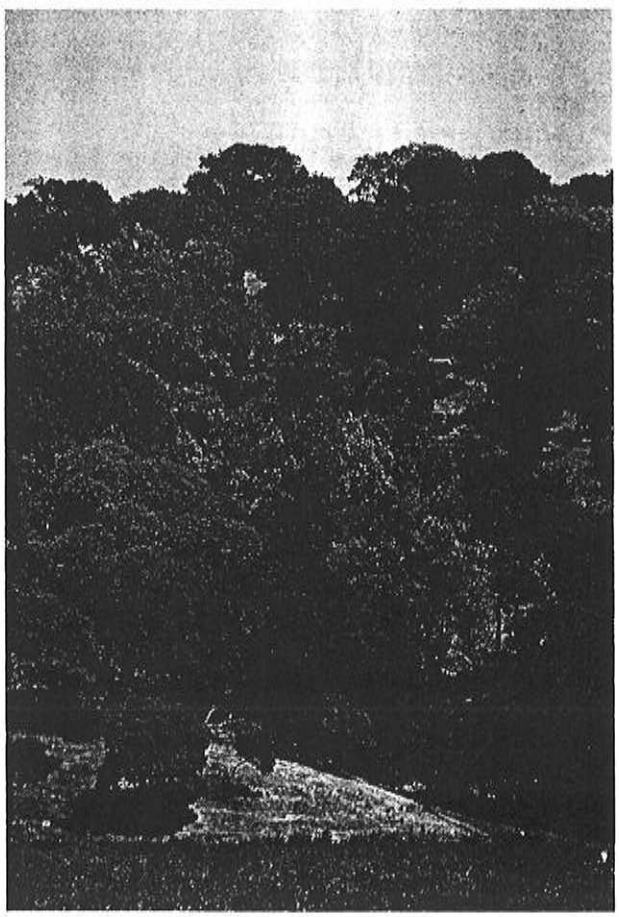
In controlled studies conducted by Phytosphere Research in 10 locations in Marin County and 1 location each in Sonoma and Napa Counties, it was determined that water stress was not a factor in tree infection. To the contrary, Q. agrifolia trees in moister sites appear to be at a higher risk of disease. No significant relationship was found between moisture levels and disease in L. densiflorus.

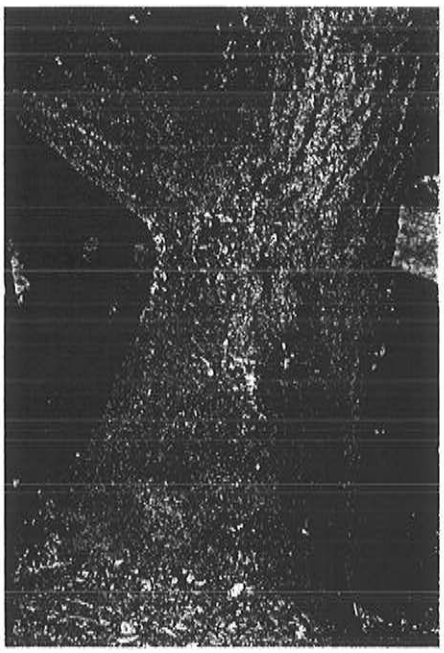
Symptoms In Oaks

According to information from the Agriculture and Natural Resources Department of the UC Cooperative Extension, the first symptoms to appear in true oaks include bleeding or oozing of a dark reddish-brown thick sap on the bark. This usually occurs on the lower portion of tree trunk (less than 10 feet high), but has been found as high as 60 feet. Underneath the oozing bark is typically a canker. On Tan Oak, the first symptom is drooping of new growth. Once weakened by P. ramorum, a common saprophytic fungus (Hypoxylon thouarsianum), ambrosia beetles (Monarthrum spp.), bark beetles (Pseudopityophthorus spp.), and other organisms often attack the trees. Trees exhibiting cankers may survive for one to several years, but once crown die back begins, the tree usually dies within a few weeks.

Transmission

Viable spores, which spread the disease, have not yet been found in infected oak tissue, although studies on the bleeding sap of oak trees suggest the presence of spores. Leaf spots caused by P. ramorum on other host species appear to be the major source of spores, which break off, disperse in water or air, and travel to a new host. In addition, these spores survive for an extended time once leaves are shed.





Preliminary studies suggest that spores can not survive without moisture in the form of water or humidity. Once moisture and temperature requirements for sporulation are determined, it will be easier to predict infections and establish barriers to the spread of the disease.

Because of the occurrence of diseased oaks at all elevations on hillsides and the above ground nature of the disease, researches believe that the P. ramorum spores may move primarily through the air. However, spores have been recovered from rainwater, soil, leaf litter, and stream water collected in woodlands with infected oak and bay laurel, suggesting that spores may travel in a number of ways.

Genetics Of The Disease

Garbelotto, Rizzo and J.M. Davidson, Department of Plant Pathology at UC Davis, are conducting genetic studies on P. ramorum to better understand its population biology and reproductive cycle, help identify it in host plants and find a control. This research indicates that P. ramorum found in the United States is less genetically diverse than the same pathogen found in Europe, suggesting that it may have originated there.

Studies have shown that black oaks are the most susceptible to the pathogen while white oaks growing next to infected black oaks do not seem to be affected. Genetic research is also being done on white oaks to determine if they have a resistant gene. If so, researchers hope to isolate and introduce it into the population helping to prevent the spread of the disease.

Chemical and Cultural Controls

Researchers Garbelotto and Rizzo have also conducted experiments in vitro and in plants seeking chemical controls for P. ramorum. Applications to infected trees were made through soil drenching, injection and topical application to the bark. Soil drenching and topical applications proved ineffective while injections into the tree produced favorable results. Chemical controls that were effective included phosphoric acid, Subdue (metalaxyl), and Allete. Although, widespread use of chemicals in woodland areas is highly unlikely, these controls will be useful in urban situations to prevent the spread of the disease in nursery stock and ornamentals.

Their research has also shown that cultural controls, such as composting, mulching, and kiln drying of infected leaf litter and wood products eliminates the pathogen. In the lab, P. ramorum is killed by exposure to 55°C for one hour. This suggests that composting at higher temperatures for longer periods will be effective in killing the pathogen. Garbelotto cautioned that composting must meet federal guidelines regarding time and temperature. To assure these requirements are met, it is best to take possibly infected material to a composting facility. Material for composting must be transported in sealed containers, and a permit is required.

Management and Prevention

Preventing the movement of infected plants, leaves, wood and soil is critical to slowing the spread of the pathogen to other oak woodlands, such as the Sierra Nevada. To help stem the spread of this disease, affected counties are requesting residents and visitors follow these guidelines:

- Plant material, leaves, wood, and soil should not be moved from coastal areas.
- Wood that has already been moved should be burned.
- Visitors to coastal forests should clean tires, shoes and animals' feet thoroughly before leaving the area.
- Construction workers should wash equipment well and should not move dirt from one place to another.
- The movement of host plants is restricted.
- 100 percent of nursery stock must be inspected and certified by the agriculture commissioner before it may be shipped.
- Land and homeowners are encouraged to maintain the health of plant material to reduce the risk of infection.

Additional Sources of Information

To report infected trees or to receive additional information, please contact your state or federal forest health specialist. On the Internet, visit the Sudden Oak Death home page at *www.suddenoakdeath.org*. To distinguish the new disease from diseases with similar appearance, visit *www.na.fs.fed.us/SOD*

Appendix C
Map of Foothills Park Showing Distribution of Major Vegetation Types

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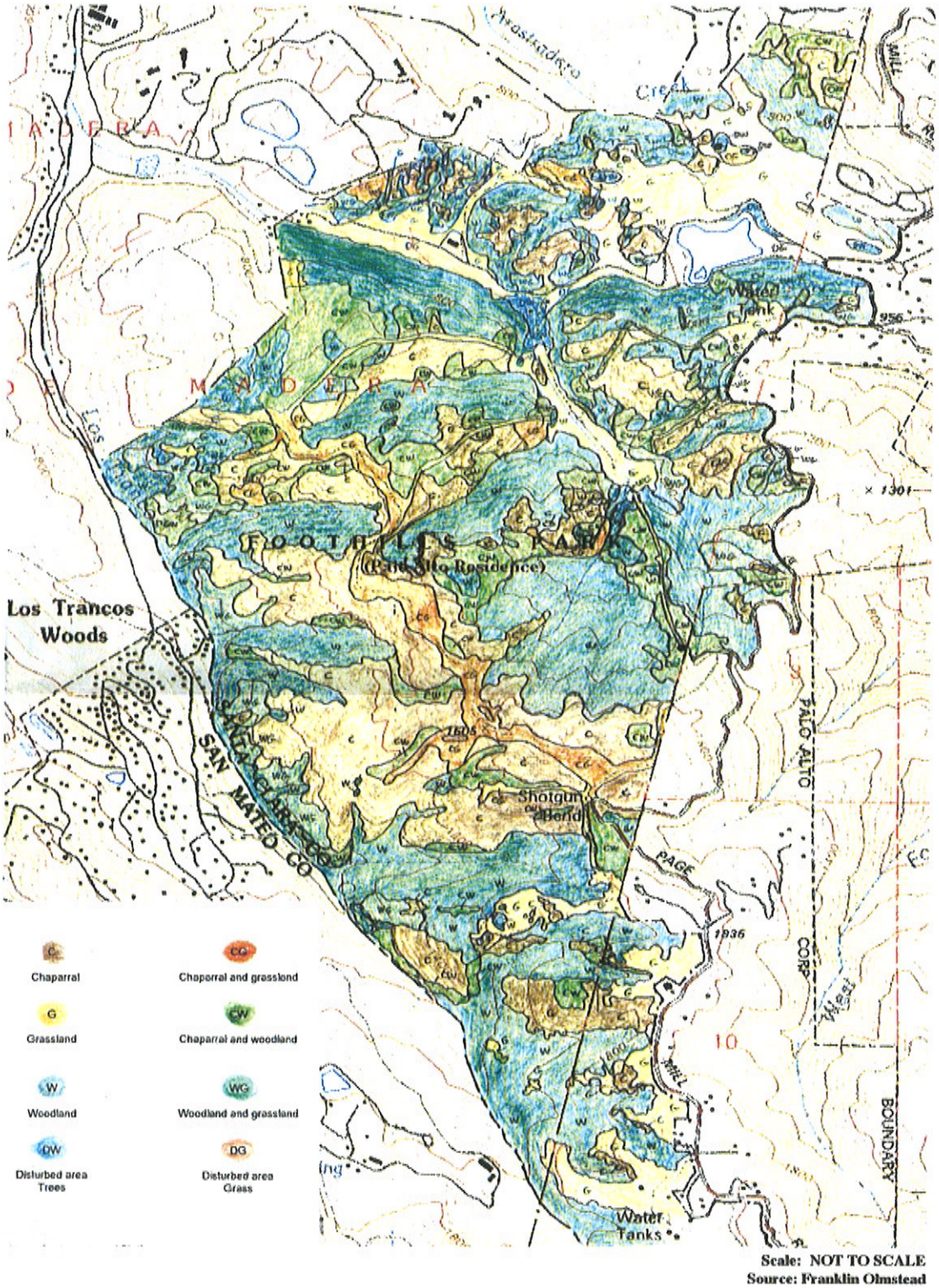
RARE PLANTS SUBJECT TO SEVERE IMPACT BY TRAIL WORK, FOOTHILLS PARK

[Plants that favor trailside locations and are rare or not likely to be seen by park visitors except along trails. This list is partial and tentative and will be modified as observations continue. **Plant type**: sh = shrub; ss = subshrub; hp = perennial herb; ha = annual herb; fe = fern]

Map symbol	Scientific name	Common name	Plant type	Comments
Ad	*Arnica discoidea*	Rayless Arnica	hp	At several places along Los Trancos Trail
Af	*Aquilegia formosa*	Crimson columbine	hp	Usually in damp, shady places along trails
Aj	*Adiantium jordanii*	Maidenhair fern	fe	Not rare but has been severely impacted by trail work, especially on Fern-loop and Steep Hollow Trails
Ak	*Antirrhinum kelloggii*	Kellogg's or lax snapdragon	ha	Seen rarely on trails in chaparral community
Au	*Allium unifolium*	Single-leaf onion	hp	Formerly more abundant
Ca	*Castilleja affinis*	Indian paintbrush	hp	Formerly much more abundant
Cc	*Clarkia concinna*	Lovely Clarkia; red ribbons	ha	Seen only on Los Trancos Trail near L.T. Creek
Cf	*Castilleja foliolosa*	Woolly Indian paintbrush	hp/ss	Not especially rare but favors trailside locations
Cov	*Cirsium occidentale venustum*	Venus thistle	hp	A native thistle; purplish-red flower color distinctive
Dc	*Delphinium californicum*	California larkspur	hp	Favors trailside locations though probably not rare
Dh	*Disporum hookeri*	Hooker's fairy bells	hp	Favors trailside locations
Dn	*Delphinium nudicaule*	Red Delphinium	hp	Favors trailside locations in dense riparian woodland
Do	*Dirca occidentalis*	Western leatherwood	sh	On CNPS endangered list; high protection priority
Dr	*Dendromecon rigida*	Bush poppy	sh	Plant at last known location removed by clearing along Trappers Trail; was formerly much more abundant
Ec	*Epilobium canum*	California Fuchsia	hp	Favors trailside locations; was spared in 1998 and 1999 by timely labeling
Fa	*Fritillaria affinis*	Mission bells	hp	Quite rare; present location(s) not known
Hp	*Helenium puberulum*	Rosilla; sneezeweed	hp	Seen at only one place along Panorama Trail
Lh	*Lotus humistratus*	Hill Lotus	ha	Less abundant than before 1998 trail work
Lw	*Lotus wrangelianus*	California Lotus	ha	Less abundant than before 1998 trail work
Pa	*Pellaea andromedifolia*	Coffee fern	fe	Rare fern in dry, sunny locations on Los Trancos Trail
Pc	*Polypodium californicum*	California polypody	fe	Not rare but has been severely impacted by trail work
Pm	*Pellaea mucronata*	Bird's-foot fern	fe	Rare fern in dry, sunny locations on Los Trancos Trail
Pt	*Pityrogramma triangularis*	Gold-backed fern	fe	Not rare but has been impacted by trail work
Rm	*Ribes malvaceum*	Chaparral currant	sh	Not rare, but much was removed by excessive trailside clearing of chaparral near Bobcat Point
Rph	*Rupertia physodes*	California tea	hp	Seen at only one place along Panorama Trail
Rv	*Ribes victoris*	Victor's gooseberry	sh	Rare species south of described range; one plant was removed by excessive trailside clearing in 1998
Sd	*Satureja douglasii*	Yerba buena	hp	Not rare, but favors slough on trails, where it was removed during trail work. It recovers only slowly
Sm	*Smilacina racemosa*	Fat false Solomon's seal	hp	Was formerly much more extensive along trails; present location(s) unknown
Ss	*Smilacina stellata*	Slim false Solomon's seal	hp	Was formerly more extensive along trails
St	*Scutellaria tuberosa*	Dannie's skullcap	hp	Rarer than Yerba buena; similarly threatened
Th	*Tauschia hartwegii*	Hartweg's Tauschia	hp	Some but not all recovers from trailside clearing
Tk	*Tauschia kelloggii*	Kellogg's Tauschia	hp	Some but not all recovers from trailside clearing
Tl	*Trientalis latifolia*	Pacific starflower	hp	Favors trailside locations in dense-shady areas
Vl	*Verbena lasiostachys*	Western Verbena	ha	Less abundant after 1998 trail work



Scale: NOT TO SCALE
Source: Franklin Olmstead

MAP OF FOOTHILLS PARK - Distribution of Major Vegetation Types