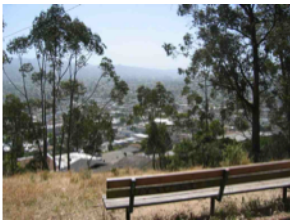


Vegetation Management Plan

Albany Hill and Creekside Park



Preliminary Draft

For presentation to
Parks & Recreation Commission
10/13/2011

Albany Hill Creekside Master Plan

Vegetation Management Plan Update

December 2011

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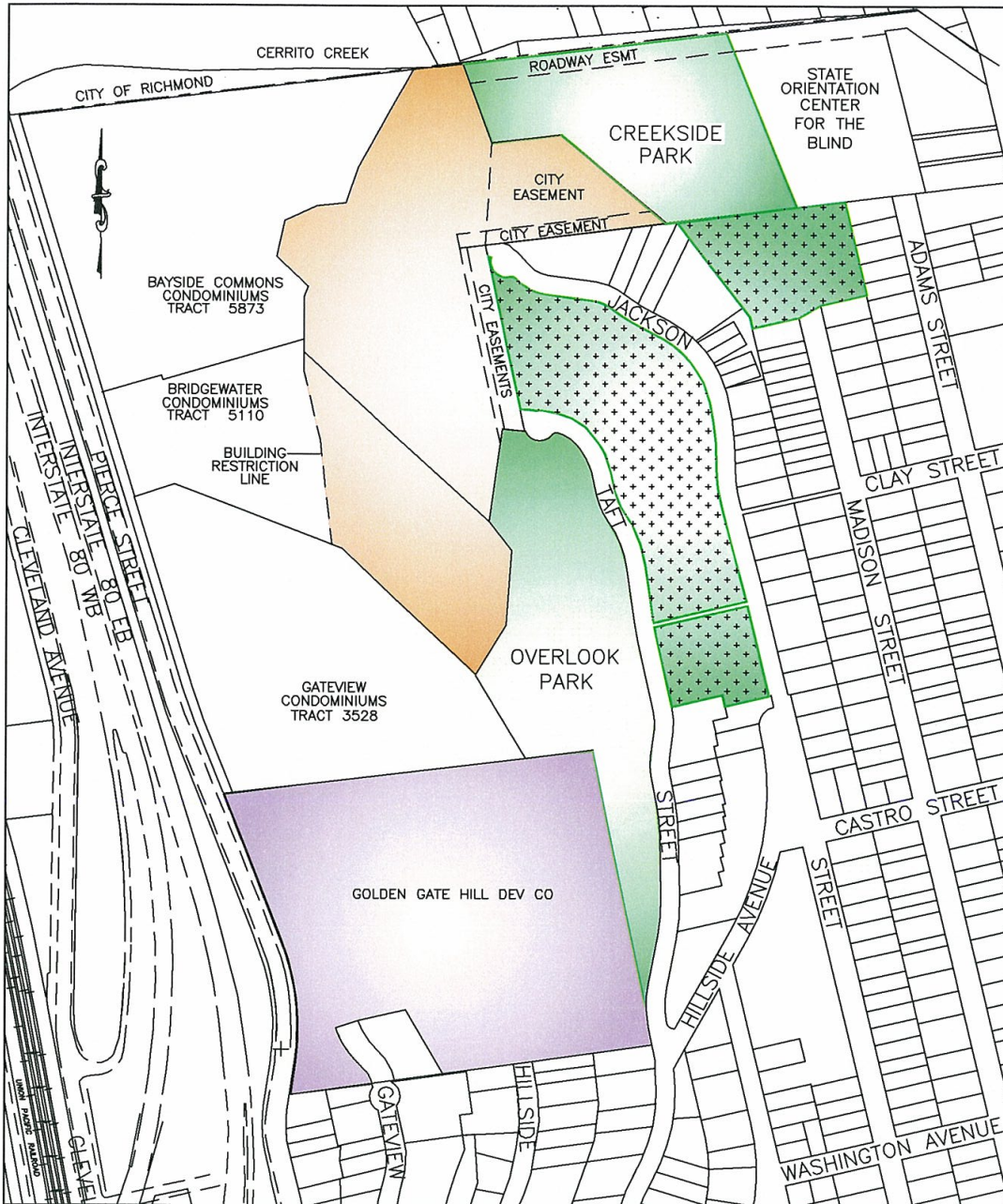
Introduction and Planning Process

The Vegetation Management Plan for Albany Hill and Creekside Park is an update of the vegetation management portion of the Albany Hill Creekside Master Plan developed in 1991. The updated plan concentrates on vegetation management with an emphasis on fire prevention and fuel management measures.

This updated plan was developed from input received from the City of Albany Parks and Recreation Commission and citizens of Albany at three public meetings held on July 14, October 13 and November 10, 2011. In addition a project web site was developed by the City staff to solicit input and update community members. Information has also been provided from two stakeholder groups: the Friends of Five Creeks and Friends of Albany Hills interested in creek restoration of Creekside Park and native plants on Albany Hill.






Four work sessions were held with staff from the City of Albany Departments of Recreation and Community Services, Public Works and Fire.

Pending: Further information about planning process and input as plan proceeds



City of Albany
Assessment District No. 1996-1

Albany Hill Open Space
& Park Acquisition Sites

-  City Trail/Open Space Easements(= 2 acres)
-  City Open Space - Measure R (= 6.6 acres)
-  City Park - Prior to Measure R (= 9 acres)
-  Private Open Space (= 11 acres)
-  Private Undeveloped Parcel (= 11 acres)

MAY 2011

A (4)

FIGURE 1

Existing Conditions and Baseline Information

Site Context and History

The Albany Hill and Creekside Park is located in northwest Albany on the north and east side of the visually predominant Albany Hill. The north boundary is formed by Cerrito Creek and the El Cerrito and Richmond city boundaries.

The park encompasses 15.6 acres on six city-owned parcels, with easements on two acres of land owned by Bayside Commons Condominiums. The park is surrounded by single-family residences on the north, east and south, and highrise condominium developments on the west. Adjacent to the park on the west is an additional 11 acres of permanent open space owned by Bayside Commons Condominiums, Bridgewater Condominiums and Gateview Condominiums. A single, undeveloped 11-acre parcel is located to the southwest.

Existing access to the site is from the ends of Taft, Jackson and Madison Streets and from Pierce Street via a trail at Bayside Commons. In addition there are numerous unofficial trails that access the site from adjacent parcels and streets. A compacted earth fire access road enters the Albany Hill portion of the park (also called Overlook Park) from Taft Street and continues on private land to connect to Hillside, Gateview and Pierce Streets. A similar fire access enters Creekside Park through the Bayside Commons Condominium parking lot and dead ends at the confluence of Cerrito and Middle Creeks. No private vehicles are allowed in the park.

The 1991 Master Plan provides a concise history of the site and background on the vegetation found there today:

"The site is dominated by Albany Hill which reaches an elevation of 330 feet. Before European settlement, the hill was

predominantly grassland with an oak woodland on the more sheltered northern slope and a creek at its northern edge. Native Americans established a village near the creek.



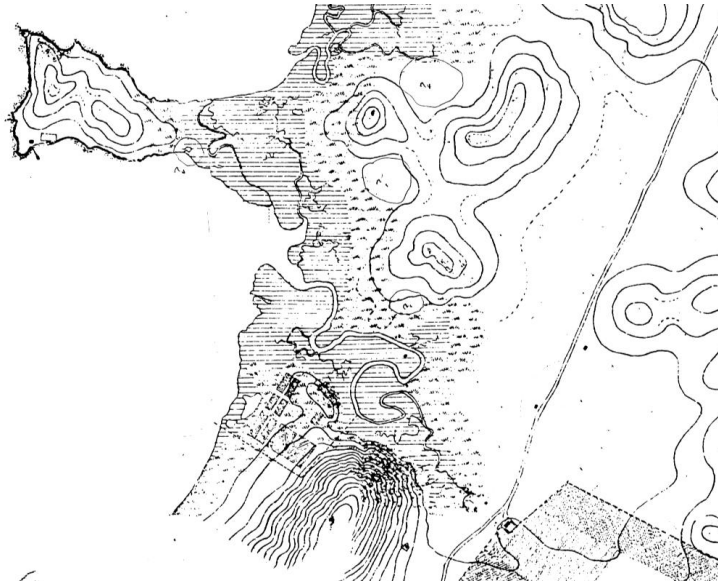
1850s photo from the east of Albany Hill (right), then El Cerrito de San Antonio, and Fleming Point (left), then El Cerrito del Sur. Note absence of trees.

From Schwartz. Undated.

With the arrival of the Spanish, the Albany Hill area was used primarily for cattle grazing. Following intensive immigration during the gold rush of the mid 1800's the site changed more rapidly. Dynamite and gun powder factories were established on the west slope of the hill. To create a buffer zone between the factories (and their accidents) and the growing residential areas, the hill was planted with hundreds of eucalyptus in the late 1800s.

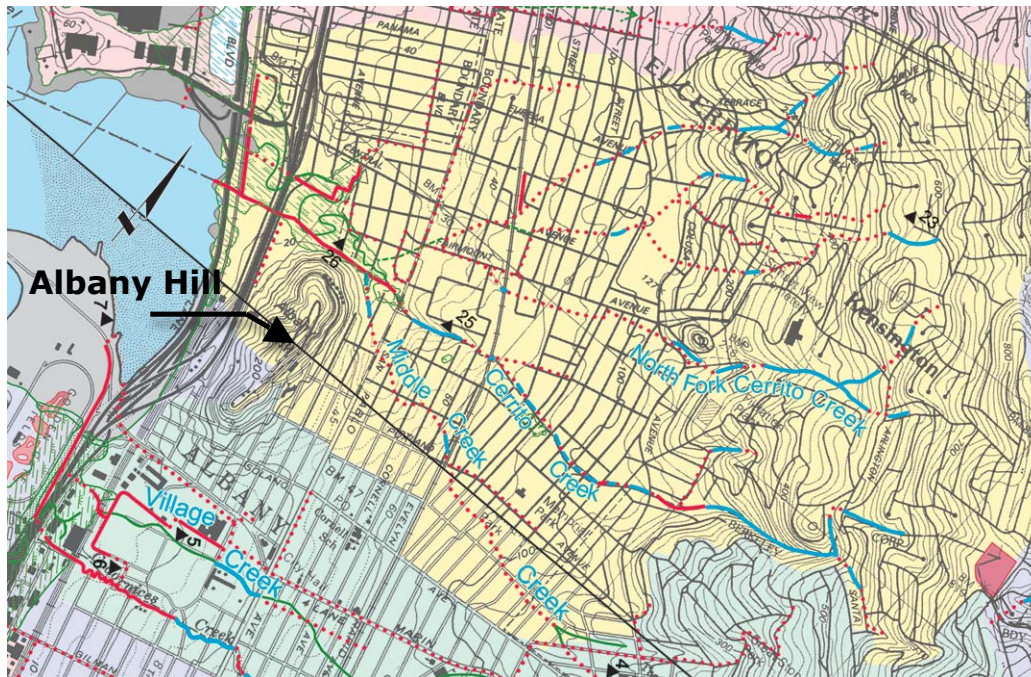
Since that time, many development schemes have been conceived for this site including a defense installation and a water reservoir. Few have materialized. Many sections of the lower portions of Albany Hill now have residential developments, but a significant portion of the Albany Hill remains as open space. The hill now serves as a landmark for Albany and the Bay Area. It is a unique

spot with rare native vegetation zones, spectacular views and quiet retreats for walkers. (Pg. 3, 1991 Master Plan)



U.S. Coastal Survey map of north end of Albany Hill, Cerrito Creek, and Pt. Isabel, 1851. Road is San Pablo Ave. Note winding creek is marsh, and small hill at northwest end of Albany Hill. Compare location on modern map below (shown in green).

From Schwartz, undated



Albany Hill

- Creeks
- Former creeks, buried or drained, circa 1850
- Natural end of creek channel, circa 1850
- Underground culverts and storm drains
- Engineered channels
- Willow groves, circa 1850
- Bay
- Beach, circa 1850
- Bay, circa 1850, now fill land
- Slough, circa 1850
- Artificial bodies of water
- Tidal marsh, circa 1850
- Present watersheds
- now water
- now fill land
- ¹⁰ Points of interest

From: Sowers, 2009.

Changes since 1991 Master Plan

Since 1991, the park has increased in size by 6.6 acres with the purchase of four parcels using Measure R funds. Two of these parcels are located at the end of Madison Street. Two of the parcels are located between Taft and Jackson Street. (see Figure 1).

The consultant team evaluated how the park vegetation has changed since the 1991 Master Plan. The city provided geographic information system (GIS) data allowed the team to overlay the parcel

boundaries on an aerial photograph to accurately depict the existing vegetation units and compare them to those mapped in the 1991 plan (Figure 2). (The 2011 unit abbreviations appear with each vegetation description.)

Eucalyptus Forest

Eucalyptus forest occurs on the top and sides of Albany hill in approximate locations as shown on 1991 plan. The consultant team recommends that the

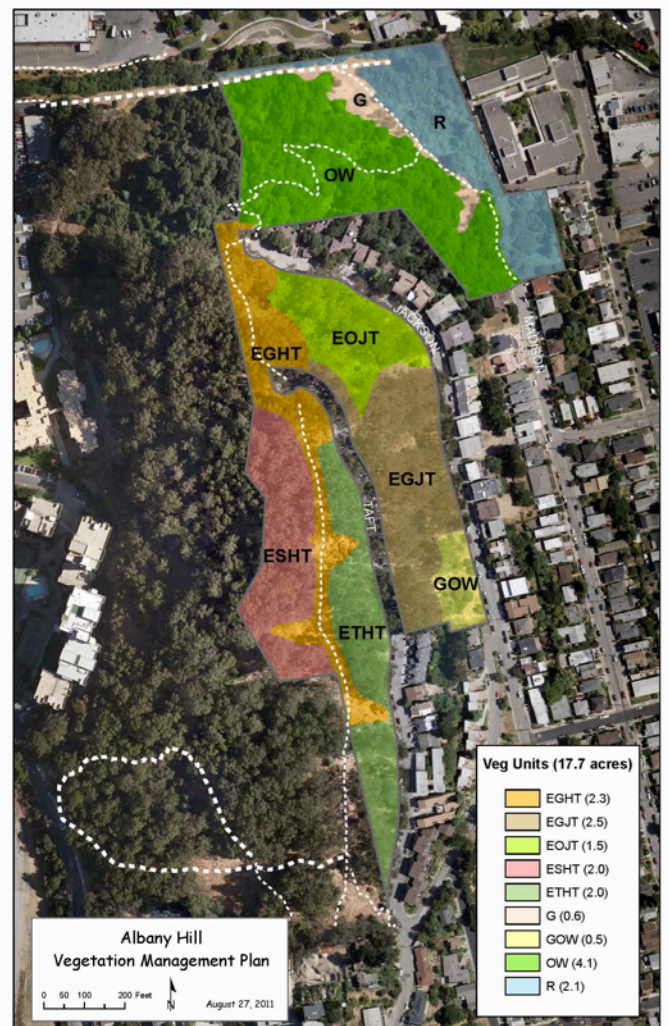
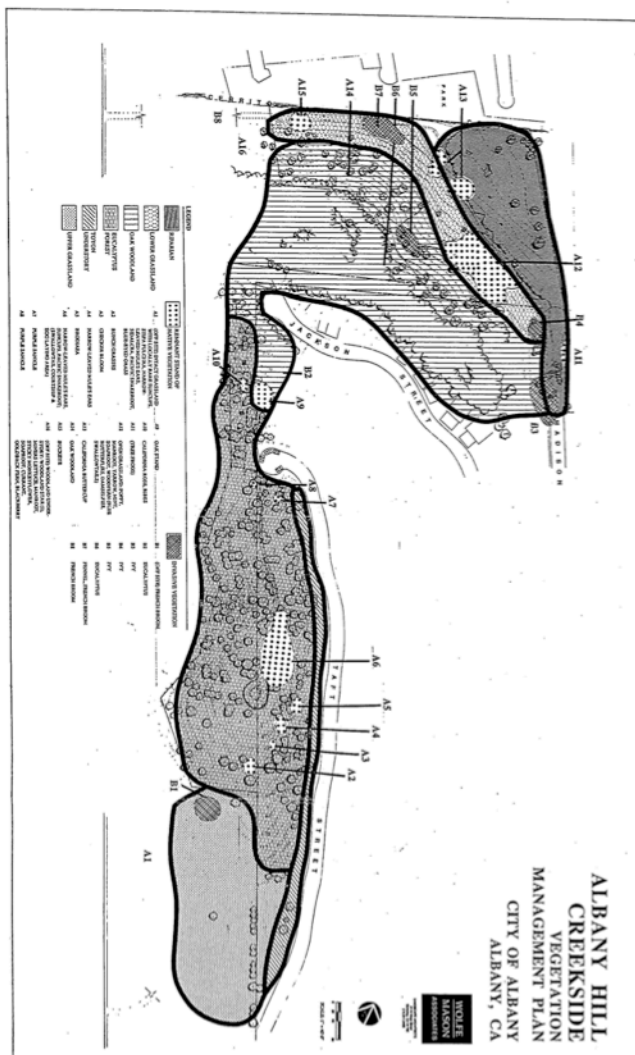


Figure 2 Comparison of 1991 and 2011 Vegetation Management Units

area be divided into three units reflecting the understory and different approaches to vegetation management from a fire management perspective.

Eucalyptus Forest Hill Top (EGHT):

On flatter top of the hill, centered on the existing fire road is mature eucalyptus with a predominately annual European grass understory (approximately 2.3 acres). This vegetation type continues along a trail through the easement to connect Taft and Jackson Streets. Native species include purple needlegrass (bunch grass), narrow mule ears, sun cups, soap root, gumplant, yarrow, iris, goldenbush, and some coyote brush.

Eucalyptus Forest Shrub Hill Top (ESHT):

On the western slopes the vegetation beneath the eucalyptus is north coastal scrub with a mix of native species including poison oak, blackberry, some coast live oak and elderberry. Non native species include annual European grasses and cotoneaster. This area is approximately 2.0 acres in size.

Eucalyptus Forest Toyon Hill Top (ETHT)

The eastern portion of eucalyptus forest has a toyon understory as identified in 1991. The toyon appears to be a wider band than shown in 1991 and covers approximately 2.0 acres. A variety of ages of plant materials were observed. It was noted in a 1972 article in the California Native Plant Society publication *Fremontia* that the toyon had been introduced by either man or birdsⁱ.

Native species include toyon, coast live oak, coyote brush, blue wild rye grass, and poison oak. Invasive, non-native species include eucalyptus, cotoneaster, pine, pittosporum and blackwood acacia.

Riparian Vegetation (R)

Riparian vegetation is approximately 2.1 acres and generally located along Middle

Creek in the lower portion of park similar to as it was shown in the 1991 Master

Plan. The area along Cerrito Creek also has the potential to support riparian vegetation and should be added to this unit. In 1991 the area along Cerrito Creek was mapped as a part of the lower grasslands.

Native species include willows, blue elderberry, native blackberries, ferns, elk clover, common horsetail and cattails that support swallowtail and buckeye butterflies, numerous species of birds, tree frogs, stickleback fish and many more as were identified in the 1991 plan. Invasive vegetation species that threatens the ecosystem are Himalayan blackberry, evergreen blackberry, Algerian ivy, capeivy, blackwood acacia, poison hemlock, and the annual European grasses. One non-native locust tree was observed in 2011. French broom and pampas grass were not observed in this area in 2011, most likely due to the efforts of volunteers and City fire management activities. However these invasive non-native species are likely to return from nearby areas should management action stop.

Grassland (G)

Grassland vegetation is approximately 0.6 acres and occurs in a narrow band in the lower part of the park between the oak woodland and the riparian units. However the band appears much narrower than mapped in 1991. This leads to a management question of how much grassland to maintain -- a narrow band along trails or wider meadows? The grasslands will need to actively managed or the vegetation type will change with natural succession from the adjacent riparian or oak woodland areas.

The grasslands are dominated by annual European grasses, though native bunch grass species and coyote brush were observed. The 1991 plan also identified California poppy, buttercup, blue-eyed grass, hedge nettle. Non native invasive species such as valerian and broom were

not observed, but this is likely due to management activities. Some fennel was observed in 2011.

Oak Woodland (OW)

The oak woodland is approximately 4.1 acres and occurs in the same locations as shown in 1991. The shape of the management unit is different today primarily because the GIS allows for an overlay of parcel boundaries with the shape the units reflecting the actual property lines. Field verification in 2011 indicates that some of the oak trees identified on the 1991 plan within or adjacent to the grasslands have matured and now shade out the grasslands.

The oak woodland has a rich diversity of species including coast live oak, buckeye, toyon trees with an shrub understory of California rose, poison oak, sticky monkey flower, currant in the more open canopy and ferns, snakeroot, hazelnut, snowberry and many more in the shaded areas. Invasive, non native species include eucalyptus, French broom, cotoneaster, fennel, Algerian ivy and annual European grasses.

Remnant Native Vegetation

The 1991 vegetation master plan map identified 16 remnant stands of native vegetation including bunch grasses, narrow-leaved mule's ears, brodiaea, pacific snakeroot, California rose, ribes, oaks, buckeye and others. These sites appeared extant in 2011 (field work was too late in the season to verify brodiaea and buttercup was not located); however, stands of purple needlegrass, blue wild ryegrass, gumplant, goldenbush, yarrow, iris, and rose thickets were observed. Some stands such as the oaks, ribes and California rose may have even expanded (the extent of stands were only diagrammatically mapped in 1991 so it is difficult to confirm extension of the area.)

Invasive Non-native Plants

The 1991 vegetation master plan map also identified 8 areas of invasive plants.

Much of the French broom and fennel located in 1991 has been removed. Other areas of French broom were observed in the new parcels and sporadically in the grassland or areas of open canopy. Additional areas of ivy were also spotted in 2011. New invasive species observed include capeivy, cotoneaster, pampas grass, pittosporum, Italian thistle, poison hemlock, blackwood acacia and locust.

New Parcels

The two new parcels of park land at the end of Madison purchase with Measure R funds are a mix of riparian, grassland and oak woodland and appear to have been mapped as a part of the 1991 plan.

The new parcels of park land between Taft and Jackson Streets are steeply sloping with a mix of vegetation. The vegetation on these parcels was not mapped during the 1991 plan.

Eucalyptus Oak-woodland Jackson Taft (EOJT)

On north and northeast facing slopes is a rich understory oak-woodland with a sparse canopy of eucalyptus (approximately 1.5 acres in size).

Eucalyptus Grassland Jackson Taft (EOJT)

The majority of the east facing slopes, 2.5 acres, has an understory of grassland with pockets of shrubs in canopy openings (including invasive, non-native species such as broom and Italian thistle).

Grassland Oak Woodland (GOW)

On lower eastern corner is annual grassland spotted with oak and buckeye trees and non-native species such as pampas grass, cotoneaster, nasturtium and other common garden species along the edge of the road.



Figure 3. Orthophoto of Site and Surrounding Area

Plan Goals and Objectives

The July 14, 2011 meeting with Parks and Recreation focused on developing goals and objectives for vegetation management. (A summary of the meeting and public input are provided in the Appendix)

The 1991 goals were confirmed as still applicable to the site:

1. Protect, maintain and enhance natural features, native vegetation & wildlife habitats of the site.
2. Protect cultural resources
3. Improve basic services to make the site safe and accessible to all people
4. Provide simple amenities that respect the site, educate the user & allow for the appreciation and enjoyment.

The key recommendations identified by the plan were also confirmed as relevant:

- Protect remaining native stands (remnant oak woodland, grasslands, toyon understory & riparian)
- Protect rare, endangered & sensitive species (monarch butterfly roosting and locally unique plant species)
- Allow for co-existence of existing eucalyptus forest with protection of woodland and grasslands
- Remove trees that threaten human safety due to unstable growth or serious fire danger
- Remove understory debris and fire ladders on annual basis
- Manage debris to reduce slip potential on trail between Taft & Jackson
- View shed protection in specific corridors including:
 - East facing bench view to east hills
 - South west facing bench view to San Francisco
 - West facing benches view to Mt Tamalpais and Golden Gate
 - Taft street circle view to Mt Tamalpais

- Creek protection and restoration
- Protect wildlife diversity
- Protect archaeological resources

Several new considerations were also discussed during the meeting and public input period. These included managing vegetation to:

- Reduce fire ignitions (from roadsides, illegal camping or smoking)
- Reduce flooding (from unmanaged vegetation in creeks or along banks)
- Discourage illegal camping (potential for fire ignitions and health/ safety issues)
- Improve visibility and security (perceived and actual park user safer)
- Improve access (keeping overgrown black berry or poison oak off of trails)

The vegetation management plan will also incorporate the application of City integrated pest management (IPM) policy and provide for education, signage and awareness activities.

Intent of the Plan

The major intent of vegetation management in the 1991 Master Plan was to "protect the remaining native stands of vegetation including an oak woodland, grasslands, a toyon understory and riparian vegetation." The plan identified that most of these remnants need human help if they are to survive as they are under "threat from introduced and invading exotics which, if not controlled, would eventually eliminate the native vegetation." The 1991 plan recommended management for a co-existence of introduced eucalyptus and several other non-native plants that have become a part of the history and appreciation of the hill for many Albany citizens.

That same intent holds true for this current plan.

Management Strategies and Actions

Fire management and prevention are a primary element of this plan, balanced by the need to reduce impact on sensitive species and protection of remnant native species. Fire is a major concern to many people in Albany. Scorch marks from a fire in 1980 are still visible on the trunks of the eucalyptus trees in the hilltop park. Many residents remember the devastating 1991 Tunnel fire in the Oakland Berkeley hills that killed 25 and injured 150 people, as well as damaged 3,354 structures spread over 1,500 acres at a cost greater than \$1.5 billion.ⁱⁱ

The Albany Hill area is a part of the city's Critical Fire Area. Within this zone there are special requirements for development. City Code Chapter XI Fire Prevention establishes weed abatement standards and authorizes the Fire Marshal to enforce requirements for the property owners to reduce fuel loads and maintain a defensible space.

Overall Goals of Fire Prevention and Fuels Management

There are three key goals for fire prevention and fuels management:

1. Reduce chance of ignition
2. Reduce potential damage from wildfire to life, property or environment
3. Improve potential for fire control by Fire Department.

Strategies – Fire Prevention and Fuels Management

For an effective fire prevention and fuels management program several strategies need to be coordinated using different types of activities. These activities include:

1. Ignition reduction through fuels management, education, engineering and enforcement (often called the "3Es" in fire prevention).
2. Fire hazard reduction through fuels management to reduce potential damage and improve opportunities for control.
3. Other fire prevention activities.
 - Private property: Reduce hazards on private properties in Critical Fire Area through inspections and enforcement of fire codes, cooperative hazard abatement and risk management.
 - Park Use: Park visitor related activities, such as education and awareness programs regarding wildfire; signage and use restrictions during periods of high fire danger weather ("Red Flag" conditions).
 - Park Management: Mechanical equipment standards for equipment safety, refueling, operations, work areas for use during fuels management, and "stop work" protocols for high fire danger weather ("Red Flag" conditions) or other periods of increased risk of ignition.

Figure 4 summarizes the goals and possible actions that can be taken for fire prevention and fuels management. Many of the actions may also support other vegetation management goals beyond fire prevention.

Figure 4. Potential Fire Management Goals and Possible Actions

Fire Management Goal	Possible Actions
Reduce the chance of damage to life and property by keeping fire from crossing boundaries – Participate in cooperative projects with adjacent landowners	<ul style="list-style-type: none"> • Fuel management to compartmentalize the landscape in to fuel management units • Fuel management along the borders of the Park • Modification of the volume or structure of the fuels to reduce chance of ember production • Modification of the volume or structure of the fuels to enhance firefighting effectiveness
Reduce damage to structures and developed areas from wildfire near structures	<ul style="list-style-type: none"> • Manage fuels per Defensible Space Guidelines to reduce flame length within 30 feet of structures • Reduce potential for ember production, especially from trees on hilltop. • Manage fuels along borders with structures, (within 30 ft) • Enhance firefighting effectiveness around structures • Reduce fuels around other “facilities” at risk (e.g. high use recreation areas)
Minimize damage to natural resources	<ul style="list-style-type: none"> • Fuel management around sensitive areas • Use of modified fire suppression in sensitive areas
Maintain ability for safe access and egress during suppression activities	<ul style="list-style-type: none"> • Roadside fuel modification to reduce fire intensity to allow for firefighting vehicles access and ensure safe evacuation (passage for park visitors and adjacent residents). • Provide access to potential wildfire locations to increase effectiveness of firefighting resources (fire road maintenance)
Reduce potential for ignitions	<ul style="list-style-type: none"> • Roadside and trailhead fuel treatments • Fuel treatments around high use areas such as benches, picnic table and other areas where people congregate. • Red flag or high fire danger weather and other educational activities, awareness campaigns and signage.
Facilitate containment and control of a fire	<ul style="list-style-type: none"> • Strategically compartmentalize fuels in order to facilitate containment and control • Modify fuels to reduce fire intensity and allow firefighters better access to the fire, slow spread of fire and make firefighting actions more effective, • Modify fuels to allow for backfires during suppression activities
Fuel modification for ecosystem health	<ul style="list-style-type: none"> • Reduce the invasion of brush into grasslands and thus reduce expected heat output • Reduce invasive non-native plant species.

Prioritizing Fuels Management Treatments

Prioritization of type and location of fuels treatment should be based on a number of factors that weigh the potential for ignition, extent of damage, aid to suppression, potential benefit to the environment, as well as feasibility and cost. Seven factors (not in priority order) include:

1. Ignition potential: Treatments are located where ignitions are most likely to occur or spread into (e.g. grass near road, trailhead, bench or picnic table). Even where an area would burn with great ferocity, if there is a lower chance of ignition, it has lower treatment priority.
2. Probability of damaging wildfire: The more the existing fuel loads and vegetation structure vary from more fire safe conditions the higher the probability of a damaging wildfire (i.e. deviation from natural fire regime).
3. Adjacency to homes or sensitive values at risk from wildfire: Closer fuel sources to homes, heavy recreational use areas, or environmentally sensitive areas have higher treatment priority. This factor looks at the way a project could minimize risk to human life, structure or environmental resources.
4. Aid to fire suppression: Treatments to modify fuels in a way that facilitates access or creates locations where successful containment is likely have greater benefit. A fire that is easy to contain will likely have fewer environmental impacts from the suppression itself.
5. Potential non-fire related benefit: Potential for public safety (falling hazards, flooding, security) or ecological benefit (or mitigation of impact resulting from exclusion of fire or other natural disturbance).
6. Window of opportunity: A project's priority may change because of funding timelines, availability of personnel or equipment, or other factors that allow it to be completed in a timely way or move the project further down on the priority list.
7. Phasing considerations: An initial treatment, such as tree removal, mechanical mowing or crushing, may be used to modify the vegetation to facilitate continued management using a different follow-up treatment, such as hand labor. If using prescribed fire, some areas may need to be pretreated or burned in a particular sequence to minimize the potential for escape.

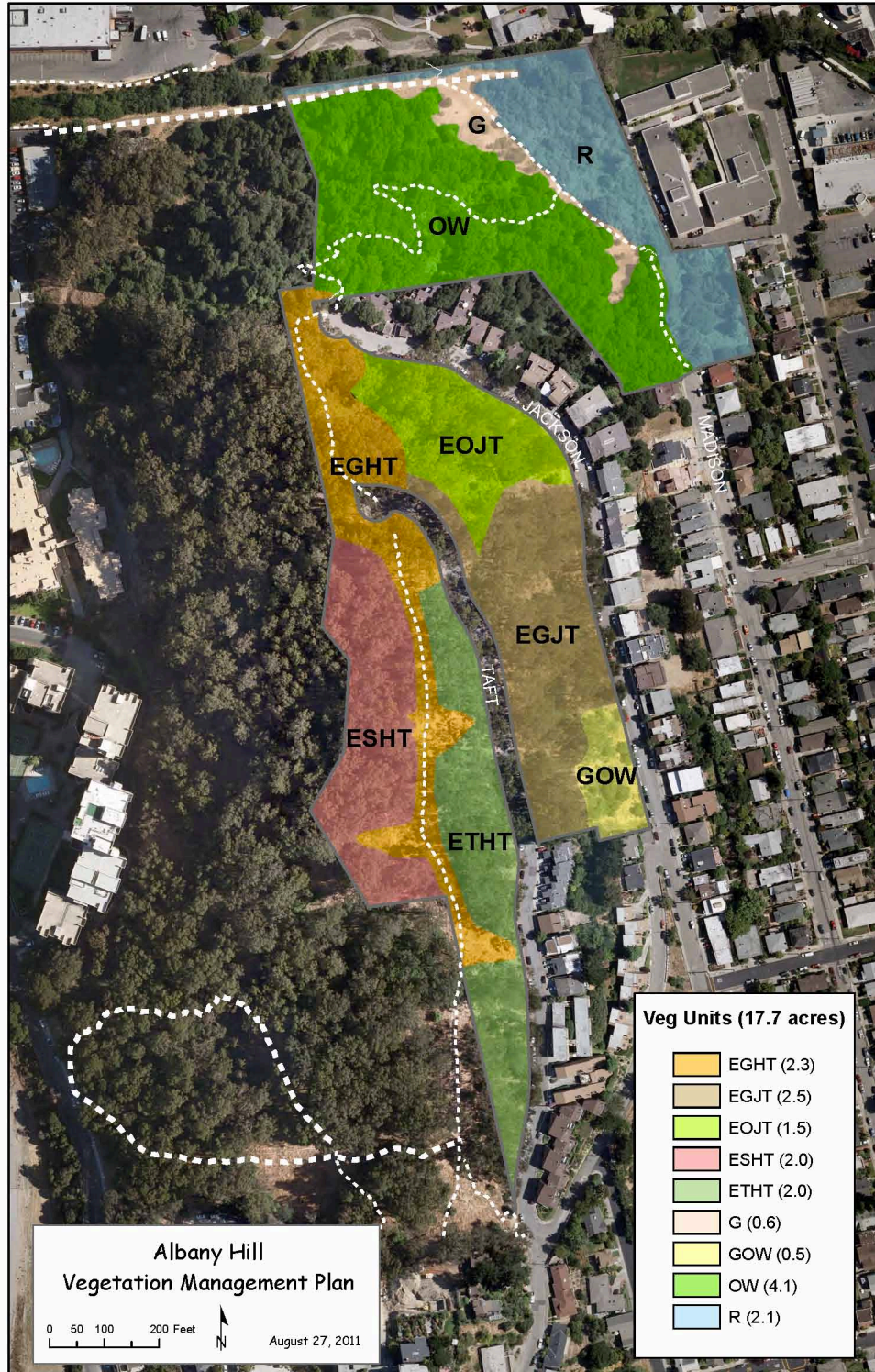


Figure 5. Vegetation Management Units

Recommended Management By Vegetation Type

Nine vegetation types were identified within Albany Hill and Creekside Park as shown on the Vegetation map in Figure 5.

General Fire Management Actions

Vegetation management for fire prevention and fuels management focuses on managing the quantity (fuel load), arrangement, and characteristics of the plant materials on a site. The actions focus on creating:

- Vertical separation between surface fuels and tree canopies. Keep fire on the ground and out of the tree crowns by reducing ladder fuels.
 - Remove loose bark or hanging branches
 - Remove resprouts, suckers or water sprouts (more hazardous due to large amount of leaves at lower levels, higher density of small stems, poor structure increases risk of future storm damage and dead materials)
 - Reduce or thin brush and tree understory
 - Remove or break-down "dead or downed" material that has an aerial component (e.g. Branches on the ground that stick up into or near live fuels should be cut up into smaller pieces so that all parts are in connection with the ground and are more difficult to ignite.)
- Horizontal discontinuity to reduce rapid fire spread.
- Reduced overall fuel load by removing dead materials and excessive duff layer (less than 2" depth is a typical goal).
- Reduced overall potential for ignitions, especially in areas where human caused ignitions are likely (such as roadsides, parking areas, fire access roads, trail heads, around benches, picnic tables and other places people congregate).
- Reduced quantity of plants with high volatile oil, leaf duff, hanging litter that are easily ignited.

Eucalyptus

(Recommendations apply to eucalyptus overstory/grass understory & eucalyptus overstory/north coastal scrub understory – 4 vegetation management units: EGHT, EGJT, EOJT, and ESHT)

Fire Hazard Concerns: This vegetation type is a high fire hazard due to volatile oils in eucalyptus leaves, high volume of forest litter accumulation, and low moisture content in shredding bark allowing easy fire ignition. Additionally vertical continuity from branches or bark that reach the ground allows for fire spread into the crown. Once fire reaches the crown of these trees embers can be carried for miles ("spotting") into other parts of the community and can be very difficult to control. The grove on the top of the hill shows sign of decline due to age and little regeneration except from resprouts from cut stumps; dead material is prevalent in the canopy of some of the trees.

Long-term Management Goals: It was observed that the eucalyptus on the hill-top does not seem to be growing vigorously. There is a lot of dead wood in the tree canopy. There appears to be little forest regeneration with young seedlings; but, rather only resprouts of formerly cut stumps. On the lower the slopes some seedlings were observed and the tree canopies appeared more densely leafed. This leads to the management question of how to manage the long-term future of the hill-top portion of the forest.

There are two options for managing the eucalyptus forest over the long term:

1. Manage for understory for grassland or shrub vegetation to become dominant vegetation type by allowing eucalyptus to die out over time and not re-generate. Do not permit seedling eucalyptus trees to develop or stumps to re-sprout. Encourage development of native tree species such as oak, toyon or elderberry for stand replacement.
2. Manage for long-term regeneration of eucalyptus forest with grass understory near fire road on ridge top and eucalyptus overstory with shrub understory on western slope. Actively encourage seedlings or re-sprouts to create the next generation of eucalyptus trees

Regardless of the long-term goal selected there is a need to:

- Manage understory fuels for fire safety and forest health. Remove "jack-pots" of dead wood, bark and other litter buildup on ground.
- Establish overstory eucalyptus trees as a well-spaced grove with approximate spacing of 20' - 30' on center or greater. Remove multiple stem resprouts that grow out of a single previously cut trunk. These second growth trees generally have weak structural connections and the multiple stems result in higher amounts of fuel and litter.
- Management of eucalyptus seedlings depends upon long-term management goal selected: If long-term goal is to retain eucalyptus overstory, manage for range of tree ages for longevity of forest. If long-term goal is to replace as grassland or shrubs remove seedlings and small trees less than 3-inch diameter or 12-feet tall on an annual or bi-annual basis.

Recommended Actions:

- Crown fire and fire spread through spotting from hilltop trees is major concern. Remove ladder fuels and create vertical separation between eucalyptus canopy and surface fuels.
- Understory low shrubs or groundcovers: Manage for separation between low shrubs or groundcovers and lower parts of eucalyptus canopy (or Toyon/ Oak canopy) of 3 times the height of understory fuel. For example a two foot shrub would require six-feet of separation from the lower parts of the eucalyptus. As shrubs age cut then to remove dead wood and allow to resprout. Maintain diversity of species with mosaic of shrub and grass understory with a maximum of 70% shrubs (in areas of shrub understory).
- Remove loose or hanging bark and vines from eucalyptus trunks and from around base of trees.
- Remove regrowth of previously cut eucalyptus stumps to eliminate sucker growth, especially where these resprouts provide connection from surface fuels to crowns of adjacent mature trees.
- Remove highly flammable or invasive non-native trees, such as blackwood acacia and Monterey pine, where they act as ladder fuels. An alternative option to removal of these trees: Manage lower portion of trees for separation from ground fuels.
- Manage fuel accumulation from litter or dead wood "jack-pots" on ground. Maximum depth of duff or mulch should be approximately 2 inches. Remove, chip or masticate all materials <3" diameter (100 hr fuels). Remove or lop and scatter >3" diameter materials provided distributed "scattered" material do not create a new fire hazard.
- Maintain eucalyptus canopy closure to shade out and prevent invasive shrubs and weeds. Establishing appropriate tree spacing will help maintain desired overall crown density.
- Selective removal from denser stands to reduce overall fuel load to achieve spacing of approximately 20-30" on center. Priority of removal should be:
 1. Cut multiple stemmed trees to result in single leader.
 2. Remove trees <8" diameter except for those trees selected and protected for forest regeneration

3. Remove larger trees.

Treatment Cycles:

Priority annual treatment:

- Annually remove ladder fuel and litter or dead wood, including eucalyptus resprouts and suckers. Removal every two years may be acceptable if resprouts and litter accumulation are moderate, except for areas of high ignition potential (such as roadsides, parking areas, fire access roads, trail heads, around benches, picnic tables and other places people congregate).
- Annually cut grass after growing season prior to fire season in areas of public access and where ignitions could occur (such as roadsides, parking areas, fire access roads, trail heads, around benches, picnic tables and other places people congregate).
- Complete annual scaled-risk assessment of trees after winter storms and remove any that threaten public safety, roadways or adjacent homes. Respond to public reports throughout the year.

Recommended 3-5 year+ treatment cycle (or longer depending on growth rate):

- Manage for separation between shrub, trees and lower parts of eucalyptus canopy.
- Cut aged shrubs to remove dead wood and allow resprouting for regeneration of shrub. Remove shrubs where encroaching into grassland understory.
- Limb up lower branches of trees to remove ladder fuels.
- Remove invasive or flammable trees serving as ladder fuels (blackwood acacia and Monterey pine).

Toyon Understory (*ETHT*)

Fire Hazard Concerns: This vegetation type is a moderate fire hazard due to higher moisture content of the toyon and coast live oak shaded by overstory eucalyptus. The key concerns are the dead material shed from the eucalyptus that becomes trapped in the toyon, oak, and other shrub layers to create a fuel ladder from the adjacent grasses, through the shrub layer, smaller stature trees and into the eucalyptus tree crown.

Long-term Management Goals: Similar to the eucalyptus forest, there are two options for the long-term management of the toyon understory:

1. Manage for toyon and coast live oak to be the dominant canopy trees by allowing eucalyptus to die out over time and not re-generate. Do not permit seedling eucalyptus trees to develop or stumps to re-sprout. Encourage development of native tree species such as oak, toyon or elderberry for stand replacement.
2. Manage for long-term regeneration of eucalyptus forest. Do not permit seedling eucalyptus trees to develop or stumps to re-sprout. Encourage development of native tree species such as oak, toyon or elderberry for stand replacement.

Regardless of the long-term goal selected there is a need to:

- Manage understory fuels for fire safety and forest health.
- Management of eucalyptus seedlings depends upon long-term management goal selected: If long-term goal is to retain eucalyptus overstory, manage for range of tree ages and species for longevity of forest. If long-term goal is for mixed toyon oak woodland, remove eucalyptus seedlings on an annual or bi-annual basis.
- To reduce overall fuel loads, establish overstory eucalyptus tree as a well-spaced grove with an approximate spacing of 20-30' on center or greater. Remove multiple stem resprouts that grow out of a single previously cut trunk. These second growth trees

generally have weak structural connections and the multiple stems result in higher amounts of fuel and litter.

Recommended Actions:

- Remove draping bark, dead materials, litter and from ground, shrubs and in toyon/ oak trees (that act as ladder fuels into eucalyptus canopy). Dead to live ratio < 20%. Mulch depth < 2" with cut pieces of mulch < 12" length.
- Selectively cut shrub species beneath toyon/ oak to achieve desired vertical and horizontal separation (ladder fuels) and reduce competition.
 - First: Remove invasive, non-native species such as cotoneaster, Himalayan blackberry, broom, pampas grass, pittosporum, young pines, blackwood acacia.
 - Second: Selective thinning or cut height of regionally common natives that will stump sprout such as poison oak, monkey flower, coyote brush. Maintain species composition. Cut so remaining standing stems of cut shrubs < 18" height.
- Encourage canopy closure of toyon/ oak trees to shade out and suppress or reduce invasive shrubs and weeds.
- Selective removal from denser stands to reduce overall fuel load to achieve spacing of approximately 25' on center. (see eucalyptus forest for details).

Treatment Cycles:

Priority annual treatment:

- Annually remove draping bark, ladder fuel and litter or dead wood. Every two years may be acceptable if litter accumulation is moderate.
- Annually cut grass or weeds in areas of public access and where ignitions could occur (such as roadsides, parking areas, fire access roads, trail heads, around benches, picnic tables and other places people congregate).
- Complete annual scaled risk assessment of overstory eucalyptus trees after winter storms and remove any trees that threaten public safety, roadways or adjacent homes. Respond to public reports related to aged or diseased trees throughout the year.

Bi-annual treatment:

- Remove eucalyptus resprouts.
- If managing for slow replacement of eucalyptus overstory with Toyon Oak, remove eucalyptus seedlings and trees less than 3" diameter in size or less than 12' in height.

Recommended 3-5 year+ treatment cycle (or longer depending on growth rate):

- Limb up lower branches of trees and remove dead wood within eucalyptus, toyon, oak and other small trees to remove ladder fuels.
- Manage for separation between shrub, trees and lower parts of eucalyptus canopy
- Cut aged shrubs to remove dead wood and allow to resprouts.
- Selective removal of eucalyptus to re-establish or maintain views from hilltop and to reduce overall fuel load.

Grasslands (*G and GOW*)

Fire Hazard Concerns: This vegetation type is a high fire hazard due to low moisture content in cured annual grasses allowing for easy fire ignition. It is also of concern due to high horizontal continuity that creates an optimum fuel bed for combustion resulting in rapid fire spread. The third characteristic of concern is the height of tall grasses that can carry fire into adjacent shrubs or low hanging trees.

Long-term Management Goals: Manage area as mixed grassland with widely spaced groupings of native oaks and shrubs (no greater than 30% of cover should be tree or shrub species). Encourage native bunch grasses, low shrubs and other forbs that stay green later in the season and are thus more difficult to ignite than annual grasses. Manage to reduce number of thistle, broom, pampas grass or other flammable, invasive, non-native species that threaten native grasslands.

Recommended Actions:

- Shorten overall height of annual grasses to decrease chance of carrying fire into taller adjacent plants. Recommended maximum standing height of remaining dead or cured grasses is between 4" and 6". Native bunchgrasses or other perennial materials may be cut higher or later in the season based upon the specific goals for a particular species. Identify protection zones to avoid mowing stands of native perennial herb/sub-shrubs, such as mules ears, native rose and gumplant,
- Shorten height of annual grasses to reduce overall fuel quantity. After growing season and prior to fire season, cut to 4-6" height
- Encourage native perennial grasses (shorter period of ignition since they are green later in summer season). Cut perennial grasses after seed set or identify protection zones to avoid cutting with annual grasses.
- Reduce brush or invasive weed encroachment to <30% in islands or "patches" to minimize heavy fuels and restrict fire duration and head output. Limb-up lower branches of trees that occur in grasslands to remove ladder fuels and prevent crown fires.
- Follow grazing protocols to avoid overgrazing and protect native species if animals are used for fuel management.
- Timing of treatment is important to maximize effectiveness: cut too early and annual grasses continue to grow; cut too late and seed may have already been produced and distributed.

Treatment Cycles:

Priority annual treatment:

- Annually cut grass after growing season and prior to fire season in areas of public access and where ignitions could occur (roadside, around benches, along fire access road).

Recommended 3-5 year+ treatment cycle (or longer depending on growth rate):

- Limb up lower branches of trees to remove ladder fuels.
- Inspect adjacent shrub and oak woodlands and remove vegetation to maintain perimeter of grasslands.

Oak Woodland (*OW and EOJT*)

Fire Hazard Concerns: This vegetation type generally is not a high fire hazard due to moisture levels, separation between overstory and lower understory and relatively lower fuel loads that make ignition more difficult. 2011 fuel loads of dead materials appear acceptable. Encourage and protect this vegetation type; work selectively at edges or when there is an increase in fuel load. Encourage canopy closure to shade out more flammable and exotic species.

Long-term Management Goals: Manage this vegetation type for a closed canopy mixed oak overstory with a rich diversity of understory. Where natural die back or storm damage create openings, encourage canopy closure through management of succession plants. Monitor for invasive or weed species, pests or disease.

Recommended Actions:

- Monitor woodland to establish IPM thresholds. Only remove dead materials if they block trail access (e.g. storm damaged trees), or have a disease or pest that threatens the overall health of woodland. Where accessible and there is a high threat of potential ignition (such as below Taft Street), remove or chip all materials <3" diameter (100 hr fuels); lop and scatter >3" diameter materials.
- Where oak is below eucalyptus overstory (between Taft and Jackson Streets) remove eucalyptus resprouts, seedlings and trees smaller than 3" diameter or less than 12' tall.
- At edges of woodland, treat adjacent vegetation type to create separation between surface fuels and aerial fuels by reducing height of shrub layer or pruning some or all of smaller (<3" diameter) lower branches (limb up) of the oaks to create 8' vertical clearance. For trees less than 24' tall limb up lower branches a maximum of 1/3 height of tree.
- In young oak thickets, encourage canopy closure. Remove understory shrubs to reduce competition and create vertical separation from surface fuels. Selectively reduce overall fuel load by removing dead twiggy materials and leaves from the young trees. Remove less vigorous or poorly shaped trees to reach a target stand density of 15-20' on center. Encourage native species diversity in trees and shrubs. Remove invasive, non-native species such as Himalayan blackberry; cotoneaster; broom; Algerian ivy; or pampas grass. Manage for understory of low herbaceous materials below canopy. Manage understory for fuel reduction only when there is a build-up of dead materials. Remove dead materials (ideal dead-to-live load ratio > 30%).
- Manage invasive non-native species for ecological restoration and habitat value. Near Madison Street Algerian ivy has dominated the Oak Woodland understory reducing the habitat value. Contain the spread of ivy into other parts of the woodland and reduce as feasible.

Treatment Cycles:

Priority annual treatment:

- Monitor and manage storm damage, pest or disease that increases potential ignitions or threatens overall health of woodland.

Recommended 3-5 year+ treatment cycle (or longer depending on growth rate):

- Manage perimeter shrubs and grasslands to remove fire ladders into oak canopy.
- Remove eucalyptus resprouts, seedlings and trees smaller than 3" diameter or less than 12' tall
- Cut aged shrubs and remove jackpots of dead wood buried below shrubs in high ignition potential areas such as below Taft Street.
- Limb up trees and cut shrubs below to remove fire ladders into oak canopy.
- Selective thin young oak thickets
- Contain/ reduce spread of Algerian ivy.

Riparian (R)

Fire Hazard Concerns: This vegetation type generally is not a high fire hazard due to moisture levels and slow response to changes in temperature and moisture that make ignition more difficult. The tree canopy forms a protective cover and typically there is no developed understory, thereby making it less susceptible to fire. Often there are low amounts of dead materials, though significant accumulations may occur from high water flows. Encourage and protect this vegetation type; work selectively at edges or when changes increase in fuel load. Encourage canopy closure to shade out more flammable and exotic species.

Long-term Management Goals: Riparian forest is valued for its productivity, wildlife habitat, as a buffer and filter for aquatic and fish habitat and for its aesthetic qualities. Treatments should be avoided in healthy riparian forests. Along Cerrito and Middle Creeks protect native vegetation and manage to encourage a closed canopy riparian forest. Manage invasive vegetation for long-term removal of Himalayan blackberry, evergreen blackberry, Algerian ivy, blackwood acacia and other fast spreading non-native plant species to meet natural resource goals.

Recommended Actions:

- Avoid treatment for fuels unless high amounts of dead materials occur. Encourage and protect the riparian vegetation type.
- Encourage canopy closure to shade out more flammable and exotic species
- Remove heavy accumulations of dead materials and reduce build up of flammable duff to < 4".
- Create separation between surface fuels (especially from adjacent areas) and aerial fuels by reducing height of shrub layer or pruning to "limb up" some or all of smaller (<3" diameter) lower branches to achieve approximately 8' vertical clearance. For trees <24' tall "limb up" lower branches no more than a maximum 1/3 height of tree. Work along edges of riparian zone in adjacent fuel types to achieve separation.
- Protect adjacent creeks from sedimentation or pollution from treatment actions. Mechanical, grazing, prescribed burning or chemical treatments generally are not recommended for riparian areas without specific mitigation measures taken to reduce potential impacts.
- Best Management Practices (BMPs) should include:
 - Minimizing soil disturbance from trampling
 - Establish a temporary protective zone between treatment area and aquatic habitat
 - Install erosion control barriers such as straw wattles
 - Require spill prevention practices and measures for all power equipment and vehicles
 - Confine activities to driest periods to minimize potential impacts to surrounding area

Treatment Cycles:

Priority annual treatment:

- Monitor and manage storm damage, pest or disease that increases potential ignitions, flooding or threaten overall health of riparian area.
- Manage invasive non-native species for ecological restoration. In addition to blackberry, a dense grove of blackwood acacia are on the east bank of Middle Creek shade out native willow and other species.

Recommended 3-5 year+ treatment cycle (or longer depending on growth rate):

- Cut blackberries to remove dead canes and from under canopy of willow and oak trees. Potential ignition sites nearby the trail and where people gather within the blackberry patch should be a priority for treatment.
- Cut and remove other dead materials throughout the riparian zone (such as dead coyote brush on the east bank of the confluence of Cerrito and Middle Creeks).

Invasive Non-native Plants

Fire Hazard Concerns: One of the greatest challenges for fire hazard fuel management is the presence of plants such as French broom, fennel, cotoneaster, pampas grass, blackwood acacia and thistle that are not only invasive but also easily ignited or highly flammable. Because of their rapid proliferation these species can add to the fuel load and fire hazard. Other species such as Algerian ivy, poison hemlock, Himalayan or evergreen blackberry are a threat as they outcompete native species. Issues concerning invasive species are of particular relevance because fuel reduction activities can inadvertently create conditions such as disturbed soil that allows the invasive species to flourish.

Long-term Management Goals: Reduce spread of invasive non-native species. Work to control existing populations complying with the City Integrated Pest Management Policy. Use principles of competitive autecology where timing and type of treatment are matched to growth stage of the plant to maximize its effectiveness. Prevent reinvasion of targeted weeds or invasion of other noxious species.

Recommended Actions:

Four weed management strategies exist for invasive plants and noxious weeds: prevention, containment, reduction and eradication. Each results in a different level of control and reflects available resources and priorities.

- Prevention: New invasions are prevented by routine monitoring and removal activities. Adoption of "early detection rapid response proactively deals with new outbreaks before they can grow into large and costly environmental threats."ⁱⁱⁱ
- Containment: Containment strategies, or the isolation of infestations from further spread, are typically used when large, aggressive infestations that cannot be eradicated threaten adjacent habitats.
- Reduction: Reduction strategies are the most commonly used strategy. They are typically used in high-value habitat areas that can greatly benefit from the reduction in the number of weedy competitors.
- Eradication: Eradication may be the goal for individual species. Even for more established species, eradication may be possible in smaller areas and is the most effective goal and strategy for small infestations. Successful eradication is a function of monitoring confidence and the life of the seed bank.

Prevention for pioneering species

Preventing a new weed from becoming established is an effective strategy. Focus first on the outlier population and remove all the plants, keeping track of locations, management strategies and results. Once the pioneering population has been removed, it's important to return every winter or spring until no more seeds are germinating. This is recommended for the isolated occurrences of capeivy, broom and pampas grass seen in the park. Early treatment prior to seed set eliminates not only the visible plants, but also potential seeds sources. Seed banks in the soil can remain viable for many decades in the case of French broom, or just a few years in the case of small-seeded plants like pampas grass.

Containment for established populations

When a particular weed has become widespread, eradication is often no longer a sensible strategy. Instead, the most effective action may be to containing its spread or lessen its impact. The aim of containment is not to eradicate the species, but to reduce its density and abundance to below an acceptable threshold.

A strategy of containment may be the best option for invasive plants like blue gum eucalyptus or Algerian ivy, which would require considerable cost and labor to fully eradicate and whose spread is often limited to areas in the immediate vicinity. For such plants, it's better to focus on containing the large infestations and eliminating all the outlier populations than to spend the high amount of money and time eradicating the main population. Containment works well with these two plants because their pattern is to spread outward from the edge of existing populations; ivy with advancing vines and eucalyptus with new seedlings and sprouts from trunks or roots (Eucalyptus seeds don't tend to disperse very far; they roll downhill on Albany Hill.)

Communicate with neighbors about weed areas, infestation levels, and control practices. Early treatment can prevent large infestations. Cooperation in adopting similar prevention practices on adjacent private property can reduce the spread of weeds into the park area. Adopt other weed control practices such as thoroughly cleaning the undercarriage of any vehicles or machinery. Require all vehicles, machinery and equipment coming into the area to be cleaned before entering. Many vegetation management companies have weed control measures and can steam clean the underside of machinery.

Reduction for established populations

Reduction strategies are the most commonly used strategy for species such as broom, blackberry or cotoneaster that have established populations within Albany Hill and Creekside Park. These strategies are typically used in high-value habitat areas, such as the riparian habitat that can greatly benefit from the reduction in the number of weedy competitors. Reduction can begin from the strategy of containment: keep working in from edges and allow adjacent native species to gradually reclaim cleared areas. It is important to keep track of the locations and size of the populations and be persistent about not only removing plants, but also about returning to the area until no more seeds germinate.

Eradication for established populations

Invasive plant species are targeted for eradication based on a high probability of success and the tolerance level for each species. A desirable goal is to obtain control of a small set of species, before targeting a different set. Recommended target invasive plant species are, blackwood acacia, young pines, Italian thistle and poison hemlock due to their rapid spread mechanisms. In other words, the population of these plants could be small, but they would cause an unacceptable impact due to their likely rapid spread (such as capeivy with advancing vines) or location in sensitive habitats.

Creating a database of location, extent, and characteristics of invasive populations can help track distribution patterns and efficacy of treatments over time. Photographs can also be linked to the database to help track progress. Geographic coordinates can be recorded using portable Global Positioning System (GPS) units and can be input into the City's existing Geographic Information System (GIS). The GPS data collection can be done by volunteers or staff, but a systematic approach to data input must be coordinated with GIS staff. Digital maps can be produced as needed for staff or community presentations. The local invasive species data can also be linked to regional databases and applications for hand held devices such as smart phones.. Additional sources for monitoring new outbreaks of invasive species in the bay area and detailed information on treatment recommendation by species see:

- California Invasive Plant Council (Cal IPC) <http://www.cal-ipc.org/>
- Bay Area Early Detection Network (BAEDN) <http://www.baedn.org/>

Treatment Cycles

Timing should be determined for each site and target invasive species. Match activity with season when the actions will be most effective to control the pest with the least effort, greatest benefit (or minimally impact) to surrounding native species (plants, animals, insects and other organisms) with the least effect on the work force (e.g. minimize exposure to poison oak). Follow up is critical to success with invasive species. Anticipate potential problems related to soil disturbance, erosion and need for follow-up treatments especially for persistent species or those with large seed banks (such French broom) or those that easily root from small pieces (such as capeivy). Many species can stump sprout or have seeds that are bird dispersed requiring continued annual management.

Figure 6. Seasonal Work Schedule (Barbara Ertter, Ph.D., Friends of Albany Hill^{iv})

Season	Prime Targets
<p>Late Summer Prior to Rain</p> <p><i>Ground hard and dry; most natives relatively dormant; poison oak leaves dropping. Good time for working in oak woodland</i></p>	<ul style="list-style-type: none"> • English and Algerian Ivy – especially climbing; prevent berry formation • Capeivy – most vulnerable; search duff for rootstocks
<p>Early rainy season (before green up)</p> <p><i>Ground softens; natives and poison oak still relatively dormant. Best time for working in oak woodland and pulling shrubs</i></p>	<ul style="list-style-type: none"> • English and Algerian ivy • Cape Ivy • French broom, and other shrubs • Seedling stage blackwood acacia, cotoneaster and eucalyptus
<p>Green up</p> <p>Natives emerge and are highly vulnerable to trampling. Poison oak leaves emerge and are most potent; ground soft. Poor time for working in most parts of oak woodland or prime wildflower areas.</p>	<ul style="list-style-type: none"> • French broom, and other shrubs • Seedling stage blackwood acacia, cotoneaster and eucalyptus • Capeivy (primarily any that is over native shrubs) • Bermuda-buttercup • Ehrharta grass
<p>Peak spring bloom</p> <p>Native herbs highly vulnerable to trampling; birds nesting in thickets along creek (avoid wildflower areas and Creekside activities).</p>	<ul style="list-style-type: none"> • Capeivy (primarily any that is over native shrubs) • Bermuda-buttercup (at most vulnerable just before flowering; should be removed from site when bulblets form at base of leaves) • Ehrharta grass (peak time: remove from site any with seeds) • Rippgut brome, wild oats, foxtail barley (pull or mow before seeds mature) • Three angled onion
<p>Late spring/ early summer</p> <p><i>Ground starting to dry; many natives going dormant (or not as vulnerable to trampling); birds still nesting in thickets along creek.</i></p>	<ul style="list-style-type: none"> • Italian thistle (before seed set) • Bur-chervil and hedge-parsley (before seed set) • Bermuda-buttercup (if still green and flowering)
<p>Dry-up</p> <p><i>Ground too dry to pull shrubs and ehrharta grass (already set seed), majority of natives going relatively dormant; birds fledged.</i></p>	<ul style="list-style-type: none"> • Poison hemlock and fennel (remove heads before seeds form) • Evergreen (thornless) blackberry • Algerian and English ivy

Figure 7. Possible Techniques for Use in Various Albany Vegetation Types

	<i>Eucalyptus Forest</i>	<i>Toyon Understory</i>	<i>Grassland</i>	<i>Oak Woodland</i>	<i>Riparian</i>	<i>Remnant Native *</i>	<i>Invasive Non-native Plants*</i>
Hand pruning and cutting							
Weed whipping	Yes	Limited	Yes	Limited	Limited	Limited	Limited
Understory pruning:	Yes	Yes	Yes	Limited	Limited	N/A	N/A
Hand pulling or cutting	Limited	Limited	N/A	Limited	Limited	Yes	Yes
Debris disposal							
Lop & scatter debris	Yes	Yes	N/A	Limited	No	No	No
Chip debris	Yes	Yes	N/A	Yes	No	No	No
Pile burning	Yes	No	N/A	No	No	Limited	Limited
Offsite removal	Yes	Yes	N/A	Yes	Yes	Yes	Yes
Tree removal							
Stand density reduction	Limited	No	N/A	No	No	N/A	N/A
Overstory removal	N/A	Limited	N/A	No	No	N/A	N/A
Sprout removal	Yes	N/A	N/A	N/A	No	N/A	Yes
Removal of trees or limbs (scaled assessment)	Yes	Yes	N/A	Limited	Limited	N/A	N/A
Mechanical treatment							
Mowing (may be done by hand – see weed whipping)	Yes	No	Yes	No	No	Limited	Limited
Crushing, masticating, or mowing brush	No	No	Limited	No	No	N/A	N/A
Grazing							
Goat grazing	Limited	No	Limited	No	No	No	Limited
Prescribed Burning							
Broadcast burning	Limited	No	Limited	No	No	No	Limited
Pile Burning	see Debris Disposal						
Integrated Pest Management Techniques							
Application of IPM	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	<i>Eucalyptus Forest</i>	<i>Toyon Understory</i>	<i>Grassland</i>	<i>Oak Woodland</i>	<i>Riparian</i>	<i>Remnant Native*</i>	<i>Invasive Non-native Plants*</i>

* Note: Remnant Native or Invasive Vegetation can be found in any vegetation unit

Technique Descriptions

Hand pruning and cutting: Pruning, cutting or removal by hand or using hand-held equipment.

Weed whipping: cutting of grasses and small shrubs with hand-held gas or electric powered tool (line or blade).

Understory pruning: removal of understory shrubs, small trees & lower limbs of trees up (“limbing up”) to create vertical separation between surface fuel and tree canopy.

Hand pulling or cutting: removal of plant materials by the roots using hands or tools (such as weed wrench) or removal by cutting and leaving roots.

Debris Disposal

Retain in place: Fine fuels such as grasses may be left where cut and allowed to decompose.

Lop and scatter debris: Heavier fuels may be cut in short lengths and scattered on site or used for erosion control or to reduce surface water flow.

Chip debris: Mechanical treatment with chipper or blade to reduce size of cut debris. Chipped materials may be redistributed on site as mulch and left to decompose. Mastication by machinery can result in a shredded or pulp-like material that decomposes faster than uniform chips.

Pile burning: Materials are arranged in piles and burned.

Offsite Removal: Removal of cut materials from site for disposal. Materials may be moved to another location on site where they can be chipped, cut for firewood or trucked from the site.

Tree Removal

Stand density reduction: selective removal of trees to reduce overall number. Selection can target deformed trees, re-sprouts, young shrubby trees, or a specific diameter or age of trees for the long-term health of the forest.

Overstory removal: Complete removal of overstory trees. This may be done to convert to understory species such as oak woodland or toyon below eucalyptus overstory.

Sprout removal: removal of re-growth from previously cut stumps. Includes manual removal on a repeated basis; use of light deprivation materials secured over stumps; grinding out of stump. (see also chemical treatment)

Removal of hazardous trees or tree limbs: removal of dead trees or tree limbs damaged by storms, frost, disease, pests, old age. May remove leaning trees, trees with roots undercut by erosion or others that threaten humans or property.

Mechanical Treatments

Mowing: A tractor with mower attachment (either rotary or flail mower) reduces the height of the grass and forbs. Can also be used on young shrubs. (see also weed whipping for use on slopes).

Crushing or mowing brush: Variety of attachments to tractor, such as blade kept off of ground, rollers or horizontal cutting blade, to crush, cut or break top of larger shrubs and compact material. Some shrubs may be uprooted and surface disturbance may occur where the tractor travels.

Grazing

Goats: Use of professional herders to use mobile band of goats to browse forbs, grass and woody material up to 6 feet above the ground. Herd movement will break off dead material in stand as well as punching a humus layer into the soil. Can graze steep slopes, but need to protect “do not remove specimens” from girdling.

Prescribed Burning

Broadcast burning: Reintroduces fire into the ecosystem. Burning is conducted over designated prepared area under specific regulations when conditions permit both adequate combustion and control. Requires burn permit.

Vegetation Management Techniques

Hand pruning and cutting:

Description: Hand pruning and cutting includes pruning, cutting or removal of targeted vegetation by hand or using hand-held equipment. It includes weed whipping, understory pruning, hand pulling or cutting. Hand labor can be used in every aspect of vegetation management with trees, shrubs, grasses and forbs, invasive weeds or native plants. It includes removal of dead wood and litter, and placing of mulch or fabric for weed control.

PROS	CONS
<ul style="list-style-type: none"> • Most selective of all techniques. Can target individual specimens or areas for treatment. Allows for protection of desirable species and other environmental resources. Can have limited impact beyond targeted plants. • Can be used in most physical settings such as steep slopes, wet ground, among trees (within safety limits of personnel). • Relatively quiet. • Can have limited amount of ground disturbance (disturbance often comes from support and haul vehicles) • Allows for involvement of volunteers and community groups. • Very useful for small scale management areas. 	<ul style="list-style-type: none"> • Low production rates typically results in more expensive costs / acre. • Cannot be used effectively for all vegetation types. • Timing of treatment critical in some vegetation types to reduce environmental impact and potential spread of invasive plants. • Difficult in some vegetation types such as poison oak or thorned blackberry due to personnel health or comfort. • Debris removal usually required. • Large volumes of foot traffic may impact site with surface erosion, compaction or damage to non-target vegetation. • Requires appropriate supervision, training, personnel safety equipment and practices for both protection of worker, retention of desired species and prevention of spread of invasive species or other environmental impact. • If power tools are utilized requires appropriate practices during refueling and equipment maintenance to prevent spills or ignitions.

Effectiveness for Fire Hazard Reduction: Hand pruning and cutting can reduce the potential of crown fire or ember production by rearranging fuel, creating horizontal and vertical separation, as well as, removal of leaf litter or shredding bark. It can be used to reduce overall height or volume of fuel, such as by shortening grass or shrubs, removing dead materials, or stopping shrubs from spreading into grasslands through selective removal. The overall positive impact of hand pruning and cutting on reduced spotting potential, heat output, rate of spread and potential ignitability depends upon how much vegetation is removed and the final arrangement, size and other characteristics of available fuel.

Follow-up: Hand labor is often used in conjunction with other management techniques. It generates debris that must be removed from site or disposed of in some manner such as burning or processing into smaller sizes by cutting or chipping so it can be distributed on site to decompose appropriately (in many grassland areas the cut grass can be left as cut to decompose).

Seasonal or Other Restrictions: Hand labor techniques have few seasonal restrictions except those set by environmental considerations such as nesting birds, potential spread of pathogens or ease and effectiveness of treatment (e.g. treatment of annual grasses after they have cured but before seed set). Precautions need to be taken during high fire danger periods to prevent hand-held equipment from inadvertently starting fires.

Best Management Practices:

- Provide for personnel safety with OSHA-compliant equipment and personal protective equipment and clothing suitable for the vegetation being treated.
- Treatment activities should not be conducted during rainstorms to reduce erosion and protect water quality of nearby creeks and drainages.
- On steep slopes, avoid excessive foot traffic that can cause compaction or erosion.
- Avoid driving support or haul vehicles off of established roads. If travel off road is required, inspect ground surface and avoid any wet areas. Spread mulch or wood chips (preferably from materials on site) to reduce potential for erosion or rutting.
- Maintenance or refueling of any equipment should take place in a designated area to reduce chance of spills or toxic material run off into adjacent areas.
- All waste, trash or debris generated by the management activities should be removed from treatment site to reduce risk of water pollution of adjacent creeks and drainages.
- Provide training to field personnel so they are able to identify and avoid any protected species, or take any other required precautions during vegetation treatments. Personnel should also be trained to identify and treat invasive species and prevent re-introduction.
- Avoid bird nests at all times during treatment. Qualified personnel should survey the area for bird nests prior to treatment if treatment is proposed between January 15 and July 15. Where nests are identified, appropriate protection and avoidance shall be incorporated into the work until the nestlings have fledged. Specifically for raptor species or those species covered by the Federal Migratory Bird Act, a qualified biologist should determine sufficient buffer areas and specific mitigation.
- Clean all tools and equipment of any remaining mud, plant or other biological materials following treatment of invasive or otherwise targeted species to avoid spreading seed or plant parts.
- Time hand treatments to prevent spread of invasive or otherwise targeted species.
- Exclude documented archaeological resources from any actions that involve ground disturbance.
- Gas-powered or other equipment that could generate a spark should not be permitted during periods of high fire danger such as "Red Flag" conditions. Albany Fire Department may specify extra precautions to allow continued equipment activity. Weed-eaters, chain saws, small mowers or other internal combustion engine powered equipment must be equipped with approved spark arrestors.

Debris Disposal

Description: Debris disposal is a critical component required for effective use of several other techniques such as hand labor or tree removal. Debris can either be retained and processed on site or transported off site for recycling or disposal. There are five common techniques used for debris disposal in the bay area that are applicable to Albany:

Retain in Place: Fine fuels such as grasses may be left where cut and allowed to blow away or decompose. Cut materials reduce potential flame height and heat output by “laying down” the fuel as compared to standing tall grass. Cut material responds well to suppression efforts.

Lop and scatter debris: Lop and scatter is traditionally used to thin forest fuel loads but can be used with understory fuels. Materials are cut in short lengths (3’ long) and scattered on site or used for erosion control or to reduce surface water flow. Materials may also be arranged in windrows or habitat piles. Materials should be laid in contact with soil to speed decomposition and reduce chance of ignition from weed growth below. Note: Lop and scatter may not be suitable for disposal branches less than 3” diameter or leaves cut from shrubs or trees where resulting fuel depth could result in fire control concerns if ignited. According to the State Public Resource Code 4551.5 resulting depth of materials should be <30”; however, in an urbanize area such as Albany a shallower maximum depth of 12” is recommended and needs to be confirmed with the Fire Marshal on a site by site case.

Chip debris: Mechanical treatment with chipper or blade to reduce size of cut debris. Typical commercial chippers can handle materials 4” in diameter and 6’ long, though tub grinders can process materials up to 24” in diameter and track chippers can handle mature trees up to 28” diameter and 160’ length. Size of chip produces depends upon machine and can be 2 to 6” in size or finer. Chipped materials may be redistributed on site as mulch and left to decompose.

Pile burning: Materials are arranged in piles and burned. Pile burning requires some of the same requirements and precautions as broadcast burning (see Prescribed Burning for further description). Bay Area Air Quality Management District (BAAQMD) has specified size and height requirements for piles that will be burned. Piles left in place for an extended period of time may become wildlife habitat or refuge areas.

Offsite Removal: Removal of cut materials from site for disposal at green waste sites. Materials may be moved to another location on site where they can be chipped, cut for firewood or trucked from the site. Potential damage from hauling equipment and removal routes must be considered.

PROS	CONS
<ul style="list-style-type: none"> • Debris disposal either removes fuel from site or processes to reduce fire hazard -- without debris disposal many other techniques are only partially effective. • More benign fire behavior and improved fire fighter safety over unmanaged debris. • Some methods recycle nutrients on site such as retain in place of fine fuels, chips or lop and scatter that are spread to decompose • On site retention methods can accommodate quarantines due to pest or disease (e.g. light brown apple moth, sudden oak death, eucalyptus borer beetle, pitch pine canker) • On site retention methods can help with erosion and weed control. 	<ul style="list-style-type: none"> • Expense for not only labor, but may also include transport and waste/ recycle charges for offsite removal. Traffic issues related to transport. • Difficult chipping or pile burning in some vegetation types such as poison oak or thorned blackberry due to personnel health or comfort. • Large volumes of foot or vehicle traffic may impact site with surface erosion, compaction or damage to non-target vegetation. • Noise and dust associated with chipping. • Air quality and escape fire concerns with burning • Erosion and sedimentation concerns associated with movement of materials for offsite removal • Public dissatisfaction with unfinished appearance of scattered materials or smoke from pile burning.

Effectiveness for Fire Hazard Reduction: Without debris disposal many of the other techniques such as hand labor or tree removal are not effective. Debris disposal techniques

are aimed at speeding decomposition by reducing the size of branches or other woody material. Large material greater than 3" may be left on-site as it is more difficult to ignite provided fine fuels have been managed.

Follow-up: Removal of material from site may require follow-up for erosion and weed control or visual appearance depending upon practices used.

Seasonal or Other Restrictions: Debris removal techniques have few seasonal restrictions except those set by the prime vegetation management technique's environmental considerations such as nesting birds, potential spread of pathogens or ease and effectiveness of treatment (e.g. treatment of annual grasses after they have cured but before seed set). Precautions need to be taken during periods of high fire danger or "Red Flag" conditions to avoid chipping or other power equipment inadvertently starting fires. Pile burning has some BAAQMD restrictions and requirements, though not as many as broadcast burning (see Prescribed Fire).

Best Management Practices:

- Maximum standing height of remaining dead grasses should be from 4" to 6". Native bunchgrasses or other perennial materials may be cut higher or later in the season based upon species' specific goals. Depth of cut grass is typically not regulated unless it creates a deep mulch layer (see mulch below).
- Widely scatter cut woody materials in order to reduce potential for ignitions. Increased slash depth may increase spotting potential, especially when located under trees or near homes, which may contribute to adverse fire behavior. Continuity of fuel, size, depth of material and compaction influence ease of ignition.
- Locate any habitat piles or windrows to remain in place with consideration of potential ignition, flame length, heat output and suppression capabilities. Deep dense windrows may require additional suppression and mop-up efforts.
- Depth of mulch should be kept 4" to 6", though temporary piles may exceed this height before they are spread. Natural compaction of chips reduces likelihood of ignition and fire spread through chips. However if ignited, chips typically smolder without high flame height and are difficult to suppress. Deep dense mulch layers may require additional suppression and mop-up efforts.
- Offsite removal requires planning of haul routes and processing sites to reduce potential environmental impacts. Traffic issues may also be associated with transport of materials.

Tree Removal

Description: Tree removal can include cutting of individual trees to removal of entire overstory canopy. Typical specialized techniques applicable to Albany Hill and Creekside Park include stand density reduction, overstory removal, sprout removal, or removal of hazardous trees or tree limbs by hand or equipment. There are machines that can cut and process trees (feller-buncher); however, they are most useful on a large scale site with gentle topography and are not likely to be used in the Park. Trees targeted for either stand density reduction or hazardous tree removal can target those specimens damaged by frost, disease, pest or old age as well as re-sprouts or misshapen trees with structural faults. Selection of trees to remove can also be based on a specific diameter or age class to manage the forest for longevity and overall health.

PROS	CONS
<ul style="list-style-type: none"> • Selective techniques. Can target individual trees for treatment. Allows for protection of desirable species and other environmental resources. • Potential for commercial value depending upon tree species, size, access, condition, quantity and other market factors. (Note: removal of commercial species may require for preparation of a Timber Harvest Plan) • May be cost effective over time compared to continual removal of understory litter or ladder fuels. • Removal of hazardous trees critical for risk management (protect against personal injury and property damage). 	<ul style="list-style-type: none"> • Expense – cost increase with tree height or diameter and proximity to homes or vegetation to be protected. • Generates considerable debris. Tree and debris removal may be expensive and can cause environmental impact (erosion, slope instability). • Physical location of trees may restrict ability to cut (or increase expense) requiring installation of erosion control measures • Skilled work - Requires appropriate supervision, training, personnel safety equipment and practices for both protection of worker, and protection of surrounding remaining vegetation • Requires appropriate practices during refueling and equipment maintenance to prevent spills or ignitions.

Effectiveness for Fire Hazard Reduction: After a tree is removed, its canopy no longer contributes to potential crown fire or ember production. Removal also reduces the potential overall surface fuels since the amount of branches, leaves, duff and shredding barking is also decreased. The overall positive impact of tree removal on reduced spotting potential, heat output, rate of spread and potential ignitability depends upon what replaces the tree overstory or what plants populate the now sunnier conditions.

Follow-up: Debris generated from tree removal (slash and logs) must be considered during project planning. If large trees are cut the removal techniques may require haul or skid routes and landing sites for further on-site processing or loading of cut material on trucks for removal from site. Smaller trees may be processed by cutting, masticating, or chipping and distributing cut materials back onto the original site. Low volumes of chips can be distributed safely without creating further fire hazard or environmental impact. Follow up treatments may be required to prevent or reduce re-sprouting of cut stumps.

Seasonal or Other restrictions: Tree removal restrictions include environmental considerations such as nesting birds and potential spread of pathogens. Debris removal has other restrictions related to equipment access (associated surface erosion, soil compaction, water quality concerns) to haul logs or remove large piles of debris. (see also prescribed burning if pile burning is considered for debris removal). Tree preservation ordinances or community concerns may dictate the notification and review process.

Best Management Practices:

- Provide for personnel safety with OSHA-compliant equipment and personal protective equipment and clothing suitable for the tools and working conditions and the type of vegetation being treated.
- Treatment activities should not be conducted during rainstorms to reduce erosion and protect water quality of nearby creeks and drainages.
- On steep slopes, avoid excessive foot traffic or activities that can cause compaction or erosion.
- Locate landing zones, haul and skid routes, staging and loading areas to minimize erosion and water quality problems. Identify sensitive receptors (adjacent homes, roadways, creeks etc.) for noise, dust and visual disturbance and incorporate actions into management activities to reduce impacts. Concentrate supporting heavy equipment use (tractor based yarding activities) in designated areas and provide appropriate

mitigation to reduce chance of rutting, erosion or sedimentation. Skidding of cut logs should be along pre-approved designated routes that minimize skidding distances and effects to sensitive areas such as roads, creeks and drainages. Total area occupied by skidding trails typically should not exceed 15% of total treatment area. To minimize soil disturbance materials should be removed by alternate routes or lopped and scattered by hand or left as long log (with branches and debris removed).

- Avoid driving support or haul vehicles off of established roads. If travel off road is required, inspect ground surface and avoid any wet areas. Spread mulch or wood chips (preferably from materials on site) to reduce potential for erosion or rutting.
- Do not operate mechanized equipment in any stream or watercourse with running or standing water to avoid runoff and contamination from equipment.
- Maintenance and refueling of equipment onsite shall be performed only when offsite operations is determined by the City to be impractical. These operations should take place in a designated area to reduce chance of spills or toxic material run off into adjacent areas. A secondary containment area, materials and supplies should be provided to facilitate prompt hazmat spill clean up. Personnel shall receive training on proper clean up methods and disposal techniques. Disposal of clean up materials shall take place off site.
- All waste, trash or debris generated by the management activities should be removed from treatment site to reduce risk of water pollution of adjacent creeks and drainages.
- Provide training to field personnel so they are able to identify and avoid any protected species, or take any other required precautions during vegetation treatments. Personnel should also be trained to identify and treat invasive species and prevent re-introduction.
- Avoid bird nests at all times during treatment. Qualified personnel should survey the area for bird nests prior to treatment for work between January 15 and July 15. Where nests are identified appropriate protection and avoidance shall be incorporated into the work until the nestlings have fledged or the nests have been abandoned. Specifically for raptor species or those species covered by the Federal Migratory Bird Act, a qualified biologist should determine sufficient buffer areas and specific mitigation.
- Clean all tools and equipment of any remaining mud, plant or other biological materials following treatment of invasive or otherwise targeted species to avoid spreading seed or plant parts.
- Time tree removal activities to prevent spread of invasive or otherwise targeted species.
- Exclude documented archaeological resources from any actions that involve ground disturbance.
- Upon completion of project all access or skid trails shall be restored to original contours, re-vegetated if necessary, and existing roads or trails returned to their original condition (or better).
- Gas-powered or other equipment that could generate a spark should not be permitted during periods of high fire danger or "Red Flag" conditions. Albany Fire Department may specify extra precautions to allow continued equipment activity. Weed-eaters, chain saws, small mowers or other internal combustion engine powered equipment must be equipped with approved spark arrestors.
- If mechanical equipment is used to support tree removal, fire suppression equipment must be available at the site and in adequate working order (per State Public Resources Code 4427(b), including a round-pointed shovel and backpack water pump. Each piece of heavy equipment shall have on-board required fire extinguisher and communications equipment to be able to report from scene of ignition.

Mechanical Treatments

Description: Mechanical treatments are typically used in grasslands, brushlands, or areas with few trees to protect or maneuver around as there is limited control over what vegetation is cut during operation. Treatments involve cutting or crushing vegetation with tractor or other machinery and can include operations such as mowing, disking or grading, mastication and crushing. Grading is often used to maintain fire trails by scraping the roadbed to bare earth that can improve access, and in some cases serve as a firebreak. Mechanical treatments are most effective in large areas with gentle topography that can be more easily accessed by the equipment (Topography is usually limited to less than 30% slopes, though some specialized equipment can operate on up to 50% slopes.) Articulated arms of some equipment permit machines to work along roadsides without having to leave the paved surface thus reducing disturbances to soil surfaces.

PROS	CONS
<ul style="list-style-type: none"> • Cost effective in large areas with relatively flat slopes or along roadsides due to fast production rates. • Can be used effectively in poison oak and blackberries • Minimum health hazard to personnel. • 	<ul style="list-style-type: none"> • Grading can disturb natural soil profiles, water drainage patterns and may sow weeds. • Mowing or disking may impact ground nesting birds or animals depending upon timing and standards • Skilled work - Requires appropriate supervision, training, personnel safety equipment and practices • Mobilization, access and maintenance associated with equipment • Requires appropriate practices during refueling and equipment maintenance to prevent spills or ignitions. • Noise and odors associated with equipment • Not suitable for steep terrain, rocky, forested areas or on easily compacted, moist or unstable soils.

Effectiveness for Fire Hazard Reduction: Mechanical treatments often rearrange rather than reduce the actual fuel. Mowing or crushing shortens the height of the fuel bed and can reduce spotting distances. The overall positive impact of mechanical treatments on reduced spotting potential, heat output, rate of spread and potential ignitability depends upon the remaining fuel bed characteristics.

Follow-up: Follow-up treatments usually target removal of any invasive species or repair of excessive surface damage left in soft ground. Sprouts may emerge from the stumps in species such as eucalyptus, requiring follow-up treatments.

Seasonal or Other Restrictions: Machinery restrictions or requirements for site-specific practices include environmental considerations such as nesting birds and potential spread of pathogens or weed seeds. Avoid archaeological sites with any ground disturbing equipment. Further restrictions are related to equipment access (associated surface erosion, soil compaction, water quality concerns). Community concerns over noise and air quality may also restrict operations. Weight of equipment may limit its use on geologically unstable areas. Treatment can be used most any time of year, but is faster in summer or fall when brush is brittle and grass cured. However, precautions need to be taken during high fire danger period to avoid machines themselves inadvertently starting fires.

Best Management Practices:

- Provide for personnel safety with OSHA-compliant equipment and personal protective equipment and clothing suitable for the tools and working conditions and the type of vegetation being treated.
- Treatment activities should not be conducted during rainstorms to reduce erosion and protect water quality of nearby creeks and drainages. Use caution when working during wet season and incorporate erosion control measures consistent with San Francisco Bay Regional Water Quality Control Board Standards. Develop a site-specific erosion control plan. Mark for high visibility wet areas not capable of supporting mechanical equipment without causing excessive rutting, erosion or sedimentation. Temporarily stop equipment work when a single pass of the equipment across a significant area of the site produces ruts deeper than 6 inches. Install waterbars, brush barriers, silt fences, hay bales, filter areas or other methods to control and capture runoff resulting from mechanical treatment actions.
- On steep slopes, avoid excessive foot traffic or activities that can cause compaction or erosion.
- Locate staging and loading areas to minimize erosion and water quality issues. Identify sensitive receptors (adjacent homes, roadways, creeks etc.) for noise, dust and visual disturbance and incorporate actions into management activities to reduce impacts. Concentrate supporting heavy equipment use in designated areas and provide appropriate mitigation to reduce chance of rutting, erosion or sedimentation occurring.
- Do not drag materials across city roads, creeks or drainage areas. Materials should be removed by alternate route or lopped and scattered by hand or left as long log (with branches and debris removed).
- Do not operate mechanized equipment in any stream or watercourse with running or standing water to avoid runoff and contamination from equipment.
- Avoid driving support or haul vehicles off of established roads. If travel off road is required, inspect ground surface and avoid any wet areas. Spread mulch or wood chips (preferably from materials on site) to reduce potential for erosion or rutting.
- Maintenance and refueling of equipment onsite shall be performed only when offsite operations is determined by the City to be impractical. These operations should take place in a designated area to reduce chance of spills or toxic material run off into adjacent areas. A secondary containment area, materials and supplies should be provided to facilitate prompt clean up of spills. Personnel shall receive training on proper clean up methods and disposal techniques. Disposal of clean up materials shall take place off site.
- All waste, trash or debris generated by the management activities should be removed from treatment site to reduce risk of water pollution of adjacent creeks and drainages.
- Provide training to equipment personnel so they are able to identify and avoid any protected species, or take any other required precautions during vegetation treatments. Personnel should also be trained to identify and treat invasive species and prevent re-introduction.
- Avoid bird nests at all times during treatment. Qualified personnel should survey the area for bird nests prior to treatment for work between January 15 and July 15 Where nests are identified appropriate protection and avoidance shall be incorporated into the work until the nestlings have fledged or the nests have been abandoned. Specifically for raptor species or those species covered by the Federal Migratory Bird Act, a qualified biologist should determine sufficient buffer areas and specific mitigation.

- Clean all tools and equipment of any remaining mud, plant or other biological materials following treatment of invasive or otherwise targeted species to avoid spreading seed or plant parts.
- Time mechanical treatments to prevent spread of invasive or otherwise targeted species.
- Exclude documented archaeological resources from any actions that involve ground disturbance. In the event that an undocumented prehistoric, historic, or paleontological site, artifact or human remains are encountered during the project all ground disturbing activities will be halted within at least 50 feet and the finds protected in place (in accordance to State and federal law) until the find is evaluated by a qualified resource consultant and appropriate mitigation is determined and implemented. In the case of human remains, the requirements of Health and Safety Code §7050.5 will be met (which involve County coroner, Native American Heritage Commission and most likely descendant notification and coordination).
- Upon completion of project all access or skid trails shall be restored to original contours, re-vegetated if necessary, and existing roads or trails returned to their original condition (or better).
- Fire suppression equipment must be available at the site and in adequate working order (per State Public Resources Code 4427(b), including a round-pointed shovel and backpack water pump. Each piece of heavy equipment shall have on-board the required fire extinguisher and communications equipment to be able to report from the scene of an ignition.

Grazing

Description: Use of animals to consume, break-off, or trample vegetation. Control of livestock, palatability of targeted plants, and prevention of impacts of overgrazing or damage to non-target species is critical to successful use of this technique. Traditional use of cattle or sheep is effective over large areas with permanent fencing. Grazing in Albany Hill and Creekside Park will most likely be restricted to the intensive short-term use of goats, especially in the shrub areas that are difficult for humans to work (such as in poison oak, blackberry or on steep slopes).

Professional herders use a mobile band of goats to browse forbs, grass and woody material up to 6 feet above the ground. Herd movement will break off dead material in a brush stand, as well as punching a humus layer into the soil. Extensive control is needed to protect "do not remove specimens" from browse, trampling or girdling, as well as to reduce erosion or meadow compaction, and protect riparian areas. A recently published guide for resource managers in coastal California^v and other sources cite beneficial impacts of livestock grazing for native grassland and wildflower restoration, weed management, and wildlife management (including endangered and otherwise protected species). The nature of goat grazing and fencing requirements reduce this technique's cost effectiveness or use as a viable method for perimeter only treatments; the larger the areas the more cost effective the technique.

PROS	CONS
<ul style="list-style-type: none"> • Cost effective in large areas in shrub or grassland • Can be used effectively in poison oak and blackberries • Minimum health hazard to humans 	<ul style="list-style-type: none"> • High cost for small areas due to transport and management • Availability limited to a few herders • Environmental concerns (sensitive species, soil erosion, water quality)

<ul style="list-style-type: none"> • Relatively quiet • Can be used in areas with tree overstory • Can be used on steep slopes • Often supported by community members • May be beneficial for native grassland and wildflower restoration, weed management and wildlife management 	<ul style="list-style-type: none"> • Animals may not eat all undesirable plants – minimum selection of target plants • Requires specialized management (temporary fencing, water, protection from predators, herd movement to prevent overgrazing) • Finished visual result may be objectionable to some • Animals can introduce weed and animal pest species • Odor and visual impact of animals
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Effectiveness for Fire Hazard Reduction: Grazing animals both remove and rearrange fuel by reducing the height of the fuel in grass and shrub areas and browsing or breaking off the lower small branches of trees to create separation between understory and tree canopies. The overall positive impact of grazing on reduced spotting potential, heat output, rate of spread and potential ignitability depends upon the remaining fuel bed characteristics, but is typically high. Goats do not need to be used every year if the intent is to manage shrub or understory fuels in treed areas. They can be rotated effectively with other techniques.

Follow-up: Follow-up treatments usually target removal of any invasive species or repair any surface damage that could lead to erosion or degrade water quality.

Seasonal or Other Restrictions: Intense grazing of animals for a short period of time could mimic the animal herds with which some native flora evolved. However grazing too early in the season could perpetuate annual grasses. Over-grazing (when excessive amount of vegetation is removed) could be detrimental by causing erosion and decline in water quality from increased sedimentation. Other environmental considerations include impacts on nesting birds (especially ground nesting) and potential spread of pathogens or weed seeds. (Animals can be fed clean feed for three days before moving to a new site to prevent spread of undesirable species. However, due to cost and space considerations of obtaining certified clean feed and holding requirements for goats during this quarantine period this option may be impractical.).

Best Management Practices:

- Develop a site specific grazing management plan with stocking levels, length of grazing period and seasons to achieve resource and fuel reduction goals. Plan should include monitoring activities and performance criteria to assess effectiveness.
- Exclude livestock from riparian areas – only during limited circumstances should livestock be used to reduce fuel loads in riparian areas. Grazing management plan to identify any sensitive species to be protected from grazing.
- Once livestock has reach pre-determined performance criteria they should be removed to avoid overgrazing or excessive hoof traffic. Inspect area at regular frequency to identify areas where bare ground is being exposed. Where excessive wear is occurring livestock should be moved to other areas and alternative treatment be considered if goals have not yet been sufficiently reached.
- Retain services of animal managers with specific experience in grazing operations for fuel reduction or environmental restoration. Operator shall also be responsible for animal health and compliance with federal and state animal health requirements.
- Exclude livestock form vicinity of documented cultural resources deemed sensitive to grazing activities (e.g. recorded site with human remains or midden).

Prescribed Burning

Description: Prescribed burning can be used to burn piles of cut brush or trees (pile burn) or over a designated prepared area (broadcast burn). Burning can only be conducted under specific regulations when conditions permit both adequate combustion and control as well as dispersal of smoke. In the Bay area, a written burn plan for broadcast burns is required by the San Francisco Bay Area Regional Air Quality Management District (BAAQMD); pile burns require submittal of Hazard Reduction Fire Notification Form "C". Reintroduces fire into the ecosystem and can closely approximate forces that have shaped natural vegetation in grasslands, shrub, oak woodland or eucalyptus forest. Both broadcast and pile burns are often used in conjunction with hand labor and mechanical treatment as a means of removing excess debris. They can also be used to benefit natural resources by reducing invasive weeds.

Broadcast burns are typically conducted over large areas where a maximum amount of fuel reduction can be achieved using roads and trails to minimize the number of fire breaks that need to be created (reducing labor costs and potential for erosion or sedimentation). In most areas another vegetation management technique is required to reduce the fuel loads and prepare the area so that a broadcast burn can safely proceed.

Pile burns are stationary fires in piles of cut brush or trees. Pile burning may be done to facilitate control of the combustion process, reduce smoke production or other operational issues. It is used in conjunction with other techniques such as hand labor or mechanical treatments as a means of removing debris. Piles may need to be moved prior to burning to avoid impacting wildlife that have begun to use the pile as habitat.

PROS	CONS
<ul style="list-style-type: none"> • May be cost effective in large areas • Promotes plants that are "fire followers" or have adapted to fire • Improves habitat quality of aged vegetation by promoting new growth • Relatively quiet • Minimal soil disturbance since less than 100% of vegetation is typically removed • Can release nutrients tied up in undecayed fuel into soil 	<ul style="list-style-type: none"> • Risk of escape fire • Public acceptance • Health issues related to smoke • Smell and visual impacts may be objectionable • Requires site preparation for initial burn • Expertise, equipment, scheduling, orientation, coordination and supervision required • Limited "burn days" in Bay Area (must wait for suitable weather conditions for burning) • Increases particulate matter in air

Effectiveness for Fire Hazard Reduction: Prescribed burning reduces the volume of fuel through combustion.

Follow-up: Post burn follow-up is required to determine if additional treatment is needed to remove burned or partially burned material, potential erosion or improve aesthetics.

Seasonal or Other Restrictions: Prescribed burning must be conducted only by trained fire management personnel. Utilizing personnel and equipment from neighboring fire districts provides the added benefit of joint training under controlled rather than emergency conditions. Prescribed burning requires the development and approval of a prescription and burn plan in order to secure approval from BAAQMD. Burn notification to neighbors, media and fire agencies is essential to avoid possible misinterpretation of the prescribed burn as a wildfire.

Best Management Practices:

- Ensure that ground cover is retained on approximately 60% of the ground to prevent soil erosion from rain and to allow precipitation to be absorbed into the ground. Where feasible, preserve a duff layer within the burn area to maintain the infiltration capability of the soils. Retain additional ground cover within 50 feet upslope of a water body.
- Establish a buffer area between the burn zone and nearby water bodies. Do not actively ignite vegetation within the buffer area. The minimum buffer should be adjusted for slope: <5% slope = 25' buffer width; 5-10% slope = 75' buffer width and >10% slope = 150' buffer width. Fire can be allowed to "back" into riparian zone; however no ignition should take place in the stream environment. High intensity burns should be kept away from creeks and drainage buffer zones.
- Minimize risk of erosion from fire lines by using existing barriers or wet lines as fire lines to minimize soil disturbance. Construct fire lines along the contour and avoid straight up/down placement whenever possible. Follow-up with erosion control measures such as water bars, turnouts and sediment traps.
- Restore firelines upon completion of prescribed burn if they are not to be used again.
- Mix torch fuels and fill torches in designated fueling areas to reduce potential areas that could be affected by hazardous materials spill.
- Prescribed burn plan to include a smoke management plan with specific detailed actions to be taken if excess smoke occurs. Address avoidance techniques for sensitive areas and potential problems related to smoke production and dispersion.
- Prescribe fire actions to include measures to manage fuel moisture. Dry dead fuels to be the focus of burning instead of green materials and other high smoke producing fuels. Fuels should be modified if necessary including removal of heavy fuels, staking and burning or some combination of activities.
- Create specific prescription for each fuel type; emphasizing "patchy" fuel consumption over much of the area.
- Divide prescribed burn areas into smaller ignition units to facilitate cessation of burning if air quality conditions deteriorate beyond acceptable levels. Use weather information to predict smoke production to further delineate burn areas and timelines.
- Remove fuel ladders reaching into tree canopy to increase fire safety and reduce possibility of green materials being torched. Lop and scatter cut materials or pile burn prior to the broadcast burn.
- Protect high value snags and large downed trees to prevent ignition an long-term smoldering.
- Conduct prescribed burn on designated burn days as authorized by BAAQMD to maximize dispersal and dilution of smoke produced, as well as when wind patterns can carry smoke away from sensitive receptors. Conduct a test burn prior to full action to determine if actual smoke dispersal will meet the requirements of the approved burn plan. Patrol burn to evaluate smoke dispersal and identify areas where additional measures (as stipulated in approved plan) need to be implemented.
- Use ignition patterns to minimize smoke production; generally backing fires against the wind and oriented such that fire spreads downhill resulting in smaller particle size and improved visibility. Use strip burns or treat with spot fires as appropriate to reduce fire residence time, total fuel burned and potential for lower duff ignition with its subsequent smoldering.
- Fully extinguish fires immediately if smoke dispersal is inadequate, blowing in the wrong direction, or spreading into sensitive areas.

- Distribute notification of prescribed burn directly to adjacent residences, through public service announcements and local media. Monitor and document smoke conditions on a smoke observation form according to requirements of the approved burn plan. Any significant change in smoke emissions or column behavior will be reported to onsite burn Incident Commander.
- Monitor at regular intervals the highway visibility in areas potentially affected by the smoke. Provide temporary caution signs warning drivers of potential reduced visibility. Notify California Highway Patrol and local County Sheriff when highways or other roadways could potentially be impacted by smoke.
- Train personnel to be able to identify protected species to be avoided during treatment, as well as, invasive or otherwise targeted species for treatment.
- Within sensitive wildlife habitats, treat burn piles in a manner that protects native wildlife that may have moved into the pile. This may include restacking the pile, igniting the pile in only one location to allow wildfire to escape or feeding fuel into a single ignited pile from adjacent piles.
- Incorporate measures into prescribed burn activities to protect active bird nests until nestlings have fledged. These measures could include scheduling burns outside of fledgling periods or providing sufficient buffer areas around nests (to be determined by qualified biologist site specific recommendations).
- Protect snags and other naturally occurring structures occupied by listed or other species targeted for protection from flames, heat and smoke.
- Train personnel of proper treatment actions and locations of known cultural sites within and around prescribed burn area.
- Ensure archaeological and other cultural resource sites are protected during any burn. This may include pre-burn site assessment; mapping and documenting previously unrecorded resources exposed by burn activities. All activities should be planned and executed in such a way to cause the least impact on cultural sites.
- Exclude cultural sites from prescribed burn areas by construction of hand lines or clearly delineating boundaries of burn area to fully exclude resource. Hand lines should be constructed just prior to the burn and removed immediately following to minimize potential risk of resource vandalism. Avoid digging, surface disturbance or displacement of soil and vegetation within the cultural resource site. Exclude mechanical equipment and minimize foot traffic within resource site. Monitor fire movement near cultural resource and ensure fires do not cross into fire-sensitive resource areas.
- Provide patrols and signage around the prescribed burn area to keep public away and provide for public safety.
- Patrol and provide signage to address potential reduced visibility from smoke. At a minimum post signs along highways and major roadways in areas where smoke will be visible or could pose a visibility concern. Post warning for drivers about potentially reduced visibility in advance of the areas where it could potentially occur. Schedule patrols at regular intervals to monitor visibility. Patrol personnel to be trained to identify conditions in which reduced visibility could occur.
- Develop an escaped fire contingency plan for all burns. Suppression actions to be taken if one of more of the following conditions exist:
 - People, facilities and or personal property are threatened.
 - Prescription limits are likely to be exceeded; e.g. higher intensity than desirable. unacceptable tree mortality, scorch or other resource damage may occur.
 - Fire threatens to spread beyond prescribed boundaries.
 - Smoke poses a hazard or is determined to be an unacceptable nuisance.

Application of City Integrated Pest Management (IPM) Policy

Description: Public health, safety and environmental concerns have limited the use of chemicals in the City of Albany and resulted in the adoption of an Integrated Pest Management (IPM) policy and regulations (Ordinance #08-01). The Integrated Pest Management Policy and Regulations (12/13/07) establishes the purpose and goals as:

“With the knowledge and understanding that we are all stewards of the earth, it shall be the policy of the City of Albany with regard to City property:

- 1) To focus on long-term pest prevention, to eliminate the use of pesticides to the maximum extent feasible, and to employ non-chemical methods first when it is determined that intervention is necessary to control a pest; and*
- 2) To use natural fertilization methods and products to promote soil and plant health to the maximum extent feasible and to eliminate use of non-organic fertilizers.”*

IPM is an approach that utilizes regular monitoring to determine if and when treatments are needed and employs, physical, mechanical, cultural, biological and educational tactics to keep pest numbers low enough to prevent intolerable damage or annoyance. Least toxic chemical controls are used as a last resort. Treatments are chosen and timed to be most effective and least disruptive to natural pest controls.

The fundamental elements of the City’s IPM policy can be applied to vegetation management as follows (*from Section 3. Integrated Pest Management Policy and Regulations 12/13/2007*):

1. Management Practices (Design and Construction): *Manage areas to “eliminate pest habitats and to be maintainable with organic fertilizers.”*
2. Pest monitoring: *“When pests are detected, monitor each pest ecosystem to determine pest population, size, occurrence, and whether or not natural enemies are present. Identify decision and practices that could affect pest populations and keep records of all of this monitoring.”* Pest monitoring can be applied to insects, pathogens or invasive species (such as light brown apple moth, sudden oak death or French broom which impact both ecosystem health and fire hazard levels).
3. Pest thresholds: *“When pests are detected, set for each pest at each site a threshold injury level, based on how much biological, aesthetic or economic damage the site can tolerate and identify an IPM implementation plan for each pest at each site.”*
4. Treatment Alternatives and Criteria: *“Consider the full range of treatment alternatives for a pest, including no action. Develop precise criteria for determining when action is necessary and when an action has proven inadequate to manage a pest.”*
5. Employ Non-pesticide Management First: *“If an action is determined to be necessary, employ non-pesticide management tactics first as follows:*
 - a. Modify maintenance and management practices*
 - b. Modify pest ecosystem;*
 - c. Use physical controls such as hand weeding, mechanical removal, traps and barriers;*
 - d. Use biological controls (introducing or enhancing pest’s natural enemies);*
 - e. Redesign the environment to eliminate pests and*

- f. Monitor treatment to evaluate effectiveness and keep monitoring records and include them in IPM implementation plan."*
6. Use Chemicals as a last resort: *"Consider use of chemicals only as a last resort and a temporary measure within a long-term IPM treatment plan designed to eliminate the need for chemical controls, following the principles below. If chemicals are determined to be necessary:*
- a. Select only the least toxic chemicals that are least disruptive to the environment, as specified on the Reduced Risk Pesticide List (see item 8 below).*
 - b. Apply pesticides in a manner that protects public health and demonstrates environmental stewardship.*
 - c. Determine the most effective treatment time, based on pest biology and other variables, such as weather, seasonal changes in wildlife use and local conditions.*
 - d. If pesticides are to be used obtain a Pest Control Advisor Recommendation, as required by law;*
 - e. Have pesticides applied only by a licensed Pest Control Operator;*
 - f. Follow specific public notification and posting requirements as detailed in the Posting/ Notice of Pesticide Use section of these regulations;*
 - g. It is unlikely that fertilization of plants would be used in vegetation management of Albany Hill and Creekside Park; however, if used it must be based on soil testing and confirmed need."*
7. Criteria for Pesticide Use and Priorities: *"Pesticides will not be used to control pests for aesthetic or economic reasons alone. Budget and staffing considerations will not be justifications for use of chemical controls and the City will strive to eliminate the use of chemical controls. Priority will be given to reduce or eliminate pesticides near watercourses and riparian areas and in areas heavily used by children.*

The IPM elements also address:

- 8. *"Establishment of a Reduced Risk Pesticide List (RRPL)"*
- 9. *"Ban of use of chemicals listed by the U.S. Environmental Protection Agency of Category I and II pesticides and chemicals identified by the State of California."*
- 10. *"An exemption process."*
- 11. *"Environmentally Preferable Fertilizer List"*
- 12. *"On-going Educational Programs for both staff and the public"*

Other operational needs such as development of an implementation manual, annual reporting and federal, state and local laws are also addressed as elements in the City IPM policy.

Effectiveness for Fire Hazard Reduction: Years of follow-up treatments are needed on cut stumps to reduce stump regrowth of trees such as eucalyptus and blackwood acacia. Annual hand removal of these sprouts offers a non-pesticide management approach that can achieve the desired vertical separation. Alternative methods such as light deprivation (with black plastic fastened over the stumps) may also prove effective depending on the number of trees that have been cut. Where the stumps are located under an existing overhead tree canopy it is critical that these sprouts, which act as "ladder fuels," be removed on a regular basis to reduce the potential for crown fire.

The overall positive impact non-pesticide management approaches (in lieu of chemical treatment) on reduced spotting potential, heat output, rate of spread and potential ignitability depends upon how much vegetation is removed and the final arrangement, size and other characteristics of available fuel.

Follow-up: Monitoring is critical to the success an integrated pest management program. A minimum of an annual assessment is needed to evaluate efficacy of the treatment method used. A flexible work program schedule is needed for timely re-treatment for resprouts or control of invasive species as needed (timed so the the treatment is most effective).

Seasonal or Other Restrictions: See other methods as selected for non-pesticide, integrated pest management approach.

Best Management Practices: See other methods as selected for non-pesticide management approach.

Monitoring program

Special Status Species

A review of the California Natural Diversity Data Base was conducted in 2011 to ascertain records of species status plants and animals from the project area (USGS Richmond quadrangle). Special status species include species of special concern (as recognized by CDFG) and listed species under state and/or federal Endangered Species Acts. Special status plants also include those listed under the California Native Plant Society Plant Rank (formerly List) 1B, which are those considered to be rare, threatened, or endangered in California.

A fall/winter-roosting site for Monarch butterfly is recorded from the southwest slope of Albany Hill. According to CNDDDB records, butterflies clustered within the eucalyptus forest on the south-western slope in the fall of 1991-92 then moved north for the remainder of the winter. Approximately 3000 butterflies were observed on the south-western slope in 1997 and 400 butterflies were observed in 1998. All of these observations appear to have occurred on or near the Golden Gate Hill Development Company property, as this property supports the most SW eucalyptus forest on Albany Hill. Further background information regarding Monarch Butterfly roosting can be found in the Appendix.

No other special status species have been recorded in the CNDDDB from the Albany Hill area. Cerrito Creek and Middle Creek do not provide suitable habitat for steelhead or California red-legged frog, The closest occurrence of the California red-legged frog is approximately 4.5 miles east. Cerrito Creek and Middle Creek may provide suitable habitat for western pond turtle; however, shallow water and human uses along the creek may make this area less desirable for this species.

Several special status plant species occur within 10 miles of Albany Hill, primarily in the Berkley Hills, Tilden Regional Park, and Wildcat Regional Park. The previously disturbed condition of Albany Hill, coupled with the dense growth of eucalyptus reduces the potential occurrence of special status plant species from the site. Surveys conducted by Friends of Five Creeks have documented the occurrence of locally unique species, such as Michael's rein orchid, marsh gumplant, stinging phacelia, coast horkelia, and Nootka rose from Albany Hill. Michael's piperia is listed on CNPS Plant Rank 4.2, a "watch list" for species with limited distribution or infrequent throughout a broader area in California.

Other records of special status species within the project vicinity occur along Cordonices Creek, which is located approximately 0.5 mile south of Albany Hill. A monarch butterfly roost occurs along Codornices Creek, east of I-80, from 1997-98. Central coast steelhead are also known to occur in Cordornices Creek.

Potential Impacts and Mitigation

As summarized in the entomological review of the plan (Arnold, August 30, 2011 – see Appendix):

"Implementation of the proposed vegetation management activities could alter habitat values to such a degree that the Monarchs would not be able to overwinter at Albany Hill. Potential impacts may include removal of nectar plants and reduction of primary and secondary wind protection.

If retention of overwintering remains a primary goal of the Vegetation Management Plan then fire preventions actions need to be focused in portions of Albany Hill where these deleterious impacts to the Monarch will not occur. At other Monarch roosting sites even seemingly minor changes in vegetation structure have degraded habitat conditions for the butterfly and in a few instances rendered a site unusable.”

Specific locations of where the butterflies roost, nectar and obtain water have not been identified to date.

It is recommended that prior to major vegetation management activities a survey be undertaken or the City sponsor a formal overwintering monitoring program. This would need to go beyond the traditional Thanksgiving census count, which tend to occur on cold, foggy or rainy days when butterflies are roosting. Observations should extend to “better weather” days and throughout the overwintering period. Observations should monitor both types of activities and where they take place to gain a better understanding of the Monarch butterflies use of the site. This information would provide specific locations and a better understanding of the potential impacts on the Monarch overwintering habitat from invasive plant removal, fire prevention and fuel reduction activities.

Detailed Implementation Plan, Schedule and Costs

Implementation Options

Detailed Implementation Plan spreadsheets identify various vegetation management actions for each of the vegetation units as describe in *Recommended Management by Vegetation Type* (page 14). These represent a range of options.

The first actions address site-wide oversight needed for an adaptive vegetation management program -- to continue successful activities and adapt those that prove to be not as cost effective. These include:

1. Administrative actions such as project administration, contracting and data collection to keep track what was done, where, when, by whom and for what cost. Ongoing vegetation and fire hazard assessments for effectiveness of program.
2. Annual monitoring necessary for an effective Integrated Pest Management (IPM) program. This monitoring sets thresholds and determines when action is warranted. In addition to monitoring, a successful IPM program includes project oversight and evaluation of techniques, adaptive management to refine activities to improve effectiveness (and reduce environmental impact), as well as training of staff and volunteers in methods and techniques.
3. Education programs, signage and awareness activities.
4. Scaled risk assessment of trees. As the eucalyptus trees decline in health a scaled risk assessment needs to be done on an annual basis of the trees located adjacent to homes or public roads. The assessment takes into consideration not only the tree condition, but also the potential for damage.

The actions are arranged by unit and are prioritized as high, moderate or low based on the factors discussed in *Prioritizing Fuel Management Treatments* (page 12). An optimum schedule or frequency of the action is also noted as either annual, bi-annual or every 3-5 years. For each action the spreadsheet lists approximate acres. A descriptive term, such as light, moderate or heavy, may follow the acreage to indicate the approximate vegetation quantities throughout the area the action will address. Many of the actions overlap each other spatially, but target different vegetation or require different contractor equipment or skills. The spreadsheet also identifies if the action is appropriate for volunteers to undertake. In some cases, portions of the activities could be supported by volunteers. The action is identified as either initial treatment or as on-going maintenance -- this directly relates to the approximate costs. Typically, the initial work in an area that treats years of build-up will be more expensive than follow up activities.

Prioritization

In general "**High**" **priority annual** actions need to be taken every year to alleviate situations that are hazardous to public safety or could cause damage to adjacent private property. These are activities that manage risk or meet existing City policies, such as the Integrated Pest Management ordinance. "Must do" activities include:

- Scaled-risk assessment of trees threatening neighboring properties or safety.

- Reducing the amount of dead materials that could be easily ignited in areas designated as potential high ignition sites (by mowing grass and removing dead bark or wood).
- Monitoring the site to establish IPM thresholds and activities.
- Removing materials in streams to reduce flooding.

Actions identified as "**High**" priority bi-annual or "**High**" priority 3-5 years are those items that can be managed with actions every 2 or 3-5 years. They include:

- Removing eucalyptus resprouts on previously cut stumps.
- Removing eucalyptus seedlings, blackwood acacia or young Monterey pines in areas where oak woodland or toyon are preferred species.
- Removing eucalyptus seedlings and eucalyptus trees less than 3" diameter breast-height or approximately 12' tall (Note this action is related to the option to manage the hilltop vegetation for succession to oak-grassland. For further discussion see page 13 under eucalyptus long-term management goals.)
- Cutting of shrubs to maintain grasslands and where they form fire ladders into the oak woodland tree canopy.
- Limbing up (removal of lower branches) of trees to remove fire ladders in grasslands, edge of oak woodland or toyon.
- Removing build-up of dead materials for those areas beneath eucalyptus.
- Cutting blackberries to reduce dead materials and security concerns.

Actions identified as "**Moderate**" priority are those that are important, but do not create a safety hazard to people or property. There are several "should do" actions that fall in this category and are effective if done on an annual basis. The longer between treatments the more difficult management becomes. These actions primarily relate to environmental health and include:

- Removing isolated or pioneering invasive non-native species throughout the site.
- Inspecting and treating riparian areas for damage, pest or disease.
- Managing invasive or non-native species for ecological restoration in the riparian area.

Many "**Moderate priority**" actions call for a **3-5 year frequency** of treatments. These include:

- Cutting shrubs to prevent them from encroaching on grasslands.
- Cutting old shrubs and blackberry to remove the build-up of dead materials.
- Removing draping bark and ladder fuels in areas that are not high ignition sites.
- Selectively removing young oaks in dense thickets to remove dead materials and allow trees to develop properly.
- Cutting dead materials throughout the riparian zone.

Actions categorized as "**Low**" priority are beneficial, such as environmental restoration activities. Some of "beneficial to do" actions need to be done on an annual basis if they are to have any effect, including:

- Mowing annual grasses before seed set to reduce competition with native plants.
- Removing non-native invasive species such as broom, thistle, pittosporum, cotoneaster, pampas grass, ivy, blackwood acacia etc. from beneath eucalyptus, in oak woodland.
- Education programs, signage and awareness activities.

Other "**Low**" priority actions last longer and can be undertaken on a 3-5 year frequency, including:

- Selectively removing eucalyptus to re-establish or maintain views.

- Selectively removing eucalyptus in denser stands to reduce the overall amount of dead materials that have to be dealt with each year.

Costs

The costs of vegetation treatments are dependent on a number of site -specific factors:

- Height, density, species and arrangement of vegetation to be treated and retained.
- Physical site conditions including size of treatment area, access, steepness, soil stability.
- Specific desired vegetation management objectives.
- Applicable regulatory requirements and resource restrictions (such as the creeks or areas of native species).
- Method of treatment prescribed (hand pulling or use of weed eaters).
- Workforce (city crews, contract labor or volunteers).
- Pre-treatment planning and post treatment assessment and monitoring required.
- Frequency of treatment and any follow up required.

Project costs are dependent not only upon the acres, type of vegetation treatments and disposal options, but also on requirements for insurance, traffic control, staging, move-in costs, bonding, administration, wage reporting.

The following table describes a range of unit costs associated with various treatment methods. The range in some cases is very wide, reflecting the impact of site-specific factors:

Vegetation Treatment	Estimated Cost per acre
Grass mowing (with mowers)	\$100 - \$500
Weed Eating (with hand held weed-eaters)	\$500 - \$3,000
Manual Brush Reduction (cutting)	\$1,500 - \$6,000
Hand Pulling	\$2,000 - \$3,000
Hand collection of small downed material (rake and take)	\$1,000 - \$5,000
Tree trimming (limbing up)	\$15,000 - \$30,000
Tree removal (<6" or 12' tall)	\$2,000 - \$5,000
Tree removal (mature trees)	\$5,000 - \$70,000

The detailed implementation plan spreadsheets found at the end of this section identify a range of costs for each of the action items identified. These figures should be used for planning purposes only and updated with bids from contractors to help refine the annual budget figures. The following range of initial costs are estimated for the various priority actions and frequency cycles:

High Priority Actions – Annual	\$43,800 - \$102,200
High Priority Action – <i>Scaled-risk assessment</i> of trees to determine potential annual abatement costs	\$5,000 to \$25,000

High Priority Action – Bi-annual frequency	\$12,150 to \$38,400
High Priority Action – 3-5 year frequency	\$25,500 to \$57,100
Subtotal High Priority Actions (year 1)	\$86,450 to \$222,700
<i>Additional High priority if Option 1 Eucalyptus management is selected (remove seedlings and small trees)</i>	<i>\$9,400 to \$21,200</i>
<i>Additional High priority if Option 2 Eucalyptus management is selected (modify spacing to reduce overall fuel load)</i>	<i>\$4,800 to \$12,000</i>
Moderate Priority Actions – Annual	\$16,000 to \$27,800
Moderate Priority Actions – 3-5 year frequency	\$30,800 to \$55,700
Subtotal Moderate Priority (year 1)	\$46,800 to \$83,500
Low Priority Actions – Annual	\$23,700 to \$38,900
Low Priority Actions – 3-5 years frequency	\$72,000 to \$232,000
Subtotal Low Priority (year 1)	\$95,700 to \$270,900
Total Estimated Costs	\$238,350 to \$598,300
<i>Note: Does not include cost for removal of hazardous trees. Includes Option 1 costs.</i>	

Funding Strategies

Multiple funding sources can provide greater stability, more money, increased continuity, a wider variety of supporting stakeholders, and the potential to expand the scope of vegetation management on Albany Hill and in Creekside Park. Each funding mechanism has unique requirements, strengths and weaknesses. Some are best suited for one-time expenditures such as tree removal that might be a part of a capital park improvements, while others are aimed at on-going maintenance activities. The “strings” attached to each mechanism should be considered.

Bond Funds – Measure R: “Measure R” was created in 1996 following an advisory public election forming a Landscape and Lighting Assessment District (LLAD 1996-1). Following passage of the measure, bonds were sold in 1998 to finance the property acquisition and capital cost. It provides funding for acquisition and improvement of open space on Albany Hill, recreational playfields and creek restoration. Funds have been used in Albany Hill Park to complete the fire mitigation work over the past few years. This has been a steady, but small amount use for a few of the highest priority items.

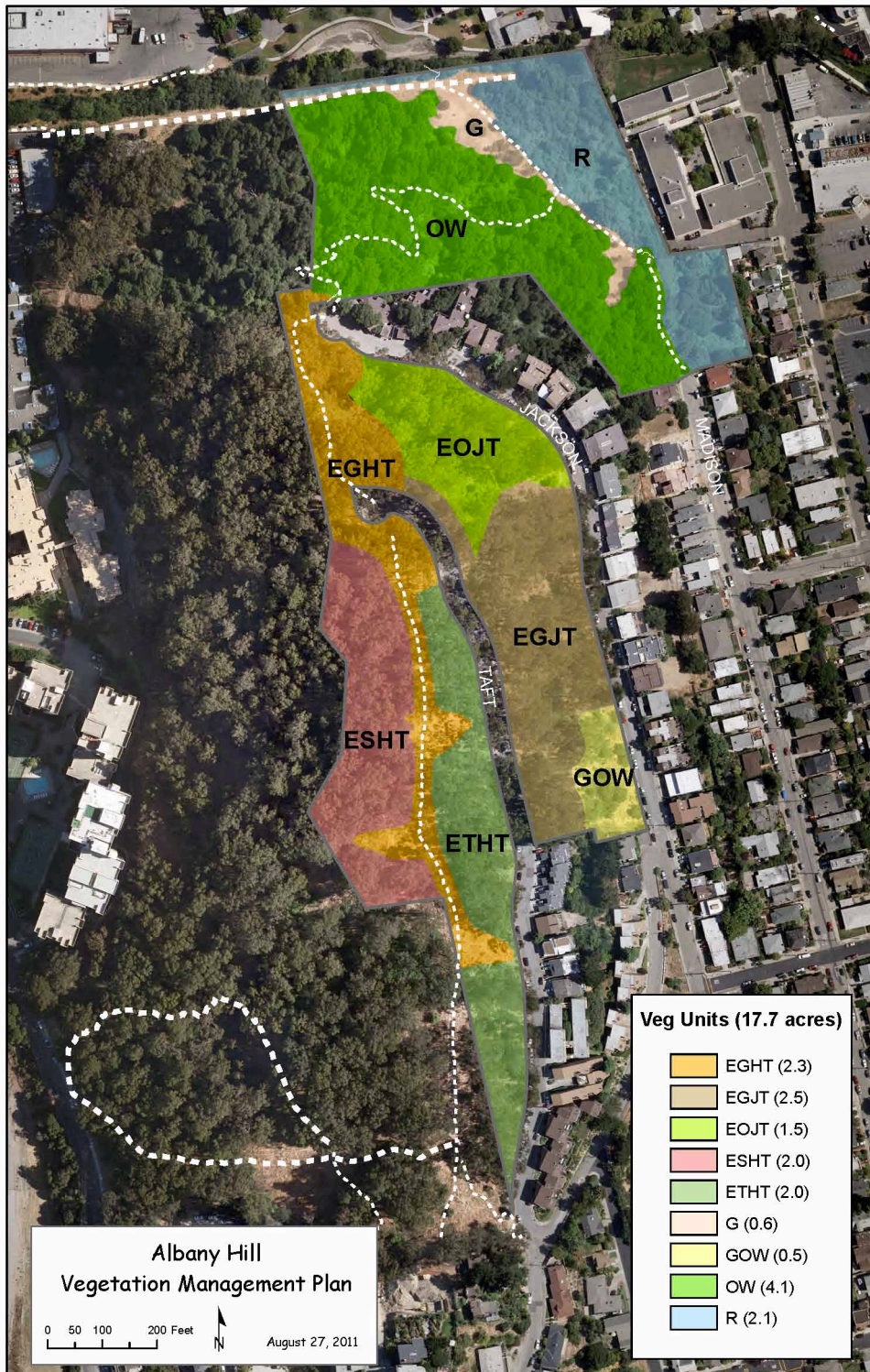
Volunteers: Albany Hill and Creekside Park have been fortunate to have on-going groups of dedicated volunteers. In recent years, volunteers have focused on two types of hand-on vegetation management activities in the park: riparian restoration in Creekside Park and removal of invasive, non-native plants such as broom on Albany Hill. City policy-makers and the City Volunteer Corps’s “Green Team” have supported these efforts. The volunteer groups have self-select their activities -- allowing for different levels of leadership and participation. Key to creek management has been the Friends of Five Creeks (website www.fivecreeks.org/). Key to activities on Albany hill has been the Friends of Albany Hill (website: www.imaja.com/as/environment/albanyca/index.html).

Throughout the East Bay corporate volunteers, such as through Chevron, Home Depot or Mechanics Bank, have participated in vegetation management activities. Corporate volunteers typically focus their work on single day efforts, where large numbers of volunteers can be orchestrated to complete a discrete task (such as broom pulling or replanting). Most corporate volunteer programs will match volunteers to on-going needs. However, the most visible activities often occur in conjunction with major regional events such as "Earth Day," United Way's Week of Caring, or some other local celebration.

Grants or private donations: Grant opportunities related to wildfire safety have increased over the past ten years with federal funding from several programs coming through the California Fire Safe Council and Department of Homeland Security, Federal Emergency Management Program. Projects that have received grant funds have included:

- Parcel based fire hazard assessments for the City of Berkeley (see Home Fire Risk viewer at map.ci.berkeley.ca.us/home_fire_risk/)
- Vegetation management projects on public lands for fire hazard reduction (East Bay Regional Park District and University of California Berkeley have both received grant funding for vegetation management fire hazard reduction projects)
- Public awareness projects and seed funds for fire reduction community projects (see Diablo Fire Safe Council www.diablofiresafe.org/current.html.)
- Claremont Canyon Conservancy, a non-profit group focused on the Claremont Canyon watershed has received both grant funds augmented by private donations for fire reduction and invasive, non-native plant management projects (website: claremontcanyon.org/.)

The recent focus of these grant programs have been on fuel reduction. Some grant programs restrict that funds cannot be used for re-vegetation. Successful grants have funded removal of eucalyptus, broom reduction and shrublands management. Funders typically want to see actions that will have either a lasting benefit or make subsequent fire management easier.



Detailed Implementation Plan

Action #	Unit	Management Action	Priority	Frequency	Approx Acres	Treatment Type	Approx. Initial Cost Contractor	Approx. Maintenance Cost Contractor	Appropriate for Volunteers
Site-wide Vegetation Management Oversight									
Admin	All	Project Administration/Contracting / GIS Data Collection	High	annual	17.6	Initial + on-going	\$8,000 to \$18,000	\$5,000 to \$18,000	some
IPM 1	All	Annual monitoring to establish IPM thresholds and activities, training & removal oversight	High	annual	17.6	Initial + on-going maintenance	\$10,000 to \$35,000	\$5,000 to \$20,000	no
IPM 2	All	Annual removal of isolated pioneering invasive non-native species	Moderate	annual	17.6 Light	Initial + on-going maintenance	\$4,500 to \$8,800	\$2,700 to \$17,600	yes
Educ	All	Education, signage and awareness program	Low	annual	17.6	Initial + on-going maintenance	\$10,000 to \$15,000	\$5,000 to \$10,000	yes
Scaled risk assessment of trees near homes and roads									
TR1	Tree Risk Overlay	Scaled risk assessment of trees that threaten public safety/ property	High	annual	7.8	Initial + on-going maintenance	\$5,000 to \$25,000	\$5,000 to \$20,000	no
TR2	Tree Risk Overlay	Remove hazardous trees	High	annual	7.8	Initial + on-going maintenance	\$150,000 to \$400,000	\$50,000 to \$200,000	no
Eucalyptus Overstory - Grass Understory on Hilltop									
EGHT 1	Euc-Grass (Hill top)	Weed-eat grass along fire access road and at high ignition sites. Identify and protect areas of native species prior to mowing.	High	annual	2.3	On-going Maintenance	N/A	\$3,500 to \$6,900	yes
EGHT 2	Euc-Grass (Hill top)	Remove draping bark, dead wood and litter buildup from along fire access road and at high ignition sites	High	annual	2.3 Moderate	Initial + on-going maintenance	\$2,800 to \$3,500	\$1,800 - \$2,300	yes
EGHT 3	Euc-Grass (Hill top)	Cut and remove all ladder fuels and vines from trees (including poison oak in vine form) adj to fire access road and high ignition sites	High	annual	2.3 Light	Initial + on-going maintenance	N/A	\$1,800 - \$2,300	yes

Action #	Unit	Management Action	Priority	Frequency	Approx Acres	Treatment Type	Approx. Initial Cost Contractor	Approx. Maintenance Cost Contractor	Appropriate for Volunteers
EGHT 4	Euc-Grass (Hill top)	Cut encroaching shrubs to maintain 2011 grass-shrub perimeter .	High	3-5 years	2.3 Light	Initial + on-going maintenance	\$2,300 to \$4,600	\$2,300 to \$4,600	yes
EGHT 5	Euc-Grass (Hill top)	Remove eucalyptus resprouts	High	bi-annual	2.3 Light	On-going maintenance	N/A	\$1,000 to \$2,300	yes
EGHT 6 Opt 1	Euc-Grass (Hill top)	Option 1 Eucalyptus Management: Remove eucalyptus seedlings and trees <3" dbh or 12' tall ("Poles")	Opt 1 High	bi-annual	2.3 Light	Initial + on-going maintenance	\$1,200 to \$2,400	\$800 to \$1,800	yes
EGHT 7	Euc-Grass (Hill top)	Remove invasive or flammable trees serving as ladder fuels to eucalyptus (acacia + Monterey pine)	High	3-5 years	2.3 Light	Initial + on-going maintenance	\$5,000 to \$20,000	\$2,500 to \$6,000	no
Eucalyptus Overstory - Grass Understory between Jackson and Taft Streets									
EGJT 1	Euc-Grass (Jackson-Taft)	Weed-eat grass + weeds along road edges high ignition sites - 30' at top of hill 10' at bottom of hill	High	annual	0.6	Initial + on-going maintenance	\$750 to \$900	\$500 to \$600	yes
EGJT 2	Euc-Grass (Jackson-Taft)	Remove draping bark, dead wood and litter buildup from along road edges high ignition sites.	High	annual	0.6	Initial + on-going maintenance	\$750 to \$900	\$500 to \$600	yes
EGJT 3	Euc-Grass (Jackson-Taft)	Cut and remove all ladder fuels and vines from trees (poison oak in vine form) adj to roadside high ignition sites	High	annual	0.6	Initial + on-going maintenance	\$750 to \$900	\$500 to \$600	yes
EGJT 4	Euc-Grass (Jackson-Taft)	Remove eucalyptus resprouts	High	bi-annual	2.4 Light	Initial + on-going maintenance	\$1,800 to \$2,900	\$1,200 to \$2,400	yes
EGJT 5	Euc-Grass (Jackson-Taft)	Remove "jack-pots" of dead wood, bark and other litter buildup on ground. Lop and scatter material >3" if removal is cost prohibitive. Chip or remove material <3" .	High	annual	2.4 Moderate	Initial + on-going maintenance	\$2,800 to \$3,600	\$1,900 to \$2,400	yes

Action #	Unit	Management Action	Priority	Frequency	Approx Acres	Treatment Type	Approx. Initial Cost Contractor	Approx. Maintenance Cost Contractor	Appropriate for Volunteers
EGJT 6 Opt 1	Euc-Grass (Jackson-Taft)	Option 1 Eucalyptus Management: Remove eucalyptus seedlings and trees <3" dbh or 12' tall ("Poles")	Opt 1 High	bi-annual	2.4 Moderate	Initial + on-going maintenance	\$1,200 to \$2,400	\$600 to \$1,800	yes
EGJT 6 Opt 2	Euc-Grass (Jackson-Taft)	Option 2 Selective removal of eucalyptus (multi-trunked & <12" dbh in denser stands) for spacing 25-30' o.c.	Moderate	3-5 years	2.4 Light	One time (+follow up)	\$4,800 to \$12,000	\$4,800 to \$12,000	no
EGJT 7	Euc-Grass (Jackson-Taft)	Cut aged shrubs and remove dead wood. Remove shrubs as required to maintain coverage <70% of area. Protect and encourage native trees.	Moderate	3-5 years	2.4 Light	Initial + on-going maintenance	\$1,000 to \$1,500	\$500 to \$750	yes
EGJT 8	Euc-Grass (Jackson-Taft)	Remove non-native invasive species - broom, thistle, pittosporum, cotoneaster, pampas grass etc.	Low	annual	2.4 Moderate	Initial + on-going maintenance	\$3,000 to \$4,500	\$750 to \$1,500	yes
Eucalyptus Overstory - Shrub Understory on Hilltop									
ESHT 1	Euc-Shrub (Hill top)	Remove "jack-pots" of dead wood, bark and other litter buildup on ground. Ok to lop and scatter material >3" if removal is cost prohibitive. Chip or remove material <3".	High	annual	2 Light	On-going Maintenance	\$2,400 to \$3,000	\$1,600 to \$2000	yes
ESHT 2	Euc-Shrub (Hill top)	Cut and remove all vines from trees (including poison oak in vine form).	High	annual	2 Light	Initial + on-going maintenance	\$2,400 to \$3,000	\$1,600 to \$2000	yes
ESHT 3 Opt 1	Euc-Grass (Jackson-Taft)	Opt 1 Euc Management: Remove eucalyptus seedlings and trees <3" dbh or 12' tall ("Poles")	Opt 1 High	bi-annual	2	Initial + on-going maintenance	\$1,000 to \$2,000	\$500 to \$1,500	no
ESHT 4	Euc-Shrub (Hill top)	Remove draping bark & other ladder fuels that connect shrub/ tree layer with eucalyptus canopy above.	Moderate	3-5 years	0.6 Light	Initial + on-going maintenance	\$750 to \$1000	\$750 to \$1000	yes
ESHT 5	Euc-Shrub (Hill top)	Cut aged shrubs and remove dead wood (currently low level of dead materials).	Moderate	3-5 years	2 Light	Initial + on-going maintenance	\$2,000 to \$4,000	\$2,000 to \$4,000	yes

Action #	Unit	Management Action	Priority	Frequency	Approx Acres	Treatment Type	Approx. Initial Cost Contractor	Approx. Maintenance Cost Contractor	Appropriate for Volunteers
Eucalyptus Overstory - Toyon Understory on Hilltop									
ETHT 1	Euc-Toyon	Remove ladder fuels. Limb-up lower branches of trees and shrubs adjacent to Euc-Grass edge and cut grass below canopy. Remove build-up of dead and downed materials on ground.	High	3-5 years	0.6 Moderate	Initial + on-going maintenance	\$2,400 to \$3,600	\$600 to \$900	no
ETHT 2	Euc-Toyon	Remove eucalyptus resprouts	High	bi-annual	2 Light	Initial + on-going maintenance	\$1,000 to \$2,000	500 to \$1,500	yes
ETHT 3	Euc-Toyon	Remove acacia under eucalyptus canopy (acting as ladder fuels) + along Taft & near Hillside	High	follow-up	2 Moderate	one time + follow up	\$5,000 to \$20,000	\$2,500 to \$10,000	no
ETHT 4	Euc-Toyon	Remove young Monterey pine trees under eucalyptus canopy (ladder fuels + high ignition potential) along Taft & near Hillside	High	one time	2 Moderate	one time + follow up	\$10,000 to \$20,000	\$1,250 to \$5,000	no
ETHT 5	Euc-Toyon	Remove draping bark that connect Toyon with eucalyptus canopy	Moderate	3-5 years	2 Moderate	Initial + on-going maintenance	\$2,400 to \$3,000	\$1,600 to \$2,000	yes
ETHT 6 - Opt 1	Euc-Toyon	Opt 1 Euc Management: Remove eucalyptus seedlings and trees <3" dbh or 12' tall ("Poles")	Opt 1 High	bi-annual	2 Light	Initial + on-going maintenance	\$1,200 to \$2,300	\$800 to \$1,800	yes
ETHT 7	Euc-Toyon	Cut aged shrubs and remove dead wood	Moderate	3-5 years	2 Moderate	Initial + on-going maintenance	\$8,000 to \$12,000	\$4,000 to \$6,000	yes
ETHT 8	Euc-Toyon	Selective removal of eucalyptus to re-establish or maintain views	Low	3-5 years	20 to 40 stems	Initial + on-going maintenance	\$24,000 to \$120,000	\$5,000 to \$20,000	no
ETHT 9 Opt 2	Euc-Toyon	Option 2 Selective removal of eucalyptus (multi-trunked & <12"dbh in denser stands) for spacing 25-30' o.c. to reduce annual fuel load	Low	3-5 years	2 Light	Initial + on-going maintenance	\$40,000 to \$100,000	\$20,000 to \$50,000	no
ETHT 10	Euc-Toyon	Remove non-native invasive species - cotoneaster, thistle, pitosporum etc.	Low	3-5 years	2 Light	Initial + on-going maintenance	\$8,000 to \$12,000	\$2,000 to \$4,000	yes

Action #	Unit	Management Action	Priority	Frequency	Approx Acres	Treatment Type	Approx. Initial Cost Contractor	Approx. Maintenance Cost Contractor	Appropriate for Volunteers
Eucalyptus Overstory - Oak Woodland between Jackson and Taft Street									
EOJT 1	Euc-Oak woodland	Inspect for annual damage, pest, disease and treat or remove as required	High	annual	1.7	Initial + on-going maintenance	\$1,600 to \$3,200	\$800 to \$1,600	no
EOJT 2	Euc-Oak woodland	Manage perimeter shrubs and grasslands to remove fire ladders into oak canopy	High	3-5 years	.2 Light	Initial + on-going maintenance	\$900 to \$1,300	\$300 to \$400	yes
EOJT 3	Euc-Oak woodland	Remove eucalyptus resprouts, seedlings and trees <3" dbh or 12' tall ("Poles")	High	bi-annual	1.7 Light	Initial + on-going maintenance	\$850 to \$1,700	\$500 to \$1,300	yes
EOJT 4	Euc-Oak woodland	Cut aged shrubs and remove jackpots of dead wood (currently moderate level of dead materials - much buried below shrubs/ vines).	Moderate	3-5 years	1.7 Moderate	Initial + on-going maintenance	\$3,400 to \$6,800	\$1,700 to \$3,400	yes
EOJT 5	Euc-Oak woodland	Manage invasive non-native species for ecological restoration (currently few invasive species some capeivy near Taft)	Low	annual	1.7 Light	Initial + on-going maintenance	N/A	\$1,700 to \$3,400	yes
Grassland - Emerging Oak Grassland between Jackson and Taft Streets									
GOW 1	Grassland - Oak Woodland	Weed-eat grass along fire access road and at high ignition sites. Identify and protect areas of native species prior to mowing.	High	annual	0.1	Initial + on-going maintenance	N/A	\$750 to \$1,000	yes
GOW 2	Grassland - Oak Woodland	Limb up branches of trees (esp. where understory shrubs) to remove ladder fuels	High	3-5 years	0.5 Moderate	Initial + on-going maintenance	\$7,500 to \$15,000	\$2,000 to \$3,000	no
GOW 3	Grassland - Oak Woodland	Maintain current size of grasslands - remove encroaching shrubs and trees.	Moderate	3-5 years	0.5	Initial + on-going maintenance	N/A	\$2,000 to \$3,000	yes

Action #	Unit	Management Action	Priority	Frequency	Approx Acres	Treatment Type	Approx. Initial Cost Contractor	Approx. Maintenance Cost Contractor	Appropriate for Volunteers
Oak Woodland in Creekside Park (between Taft and Madison Streets)									
OW 1	Oak woodland	Inspect for annual damage, pest, disease or access and treat or remove as required.	High	annual	4.1	On-going Maintenance	\$1,600 to \$3,200	\$800 to \$1,600	no
OW 2	Oak woodland	Limb up trees (1/3 height or 8 max') and cut shrubs to remove fire ladders into oak canopy.	High	3-5 years	0.2 Moderate	Initial + on-going maintenance	\$3,000 to \$6,000	\$800 to \$1,200	Yes- shrubs no trees
OW 3	Oak woodland	Selective removal in young oak thickets to remove dead wood, select for best oak trees	Moderate	3-5 years	.47 Heavy	Initial + on-going maintenance	\$7,000 to \$15,000	\$2,000 to \$3,000	no
OW 4	Oak Woodland	Contain/ reduce spread of Algerian ivy in oak-woodland near Madison	Low	annual	1 Heavy	Initial + on-going maintenance	\$4,000 to \$6,000	\$2,000 to \$5,000	yes
Grassland in Creekside Park									
G 1	Grasslands	Weed-eat grass along trail, fire road and high ignition sites. Identify and protect areas of native species prior to mowing.	High	annual	0.6	On-going maintenance	N/A	\$900 to \$1,800	yes
G 2	Grasslands	Limb up branches of trees (esp. where understory shrubs) to remove ladder fuels	High	3-5 years	0.6 Moderate	Initial + on-going maintenance	\$2,400 to \$3,600	\$600 to \$900	no
G 3	Grasslands	Remove encroaching shrubs. Maintain 2011 boundaries as approx. 70% open grassland.	Moderate	3-5 years	0.4	Initial + on-going maintenance	N/A	\$1,600 to \$2,400	yes

Action #	Unit	Management Action	Priority	Frequency	Approx Acres	Treatment Type	Approx. Initial Cost Contractor	Approx. Maintenance Cost Contractor	Appropriate for Volunteers
Riparian in Creekside Park									
R 1	Riparian	Along path - remove dead canes from blackberries and cut from beneath willow, oak trees (10' wide)	High	3-5 years	0.2 Moderate	Initial + on-going maintenance	\$2,000 to \$3,000	\$800 to \$1,200	yes
R 2	Riparian	Cut and remove dead materials throughout riparian zone	Moderate	3-5 years	2 Moderate	Initial + on-going maintenance	\$2,400 to \$6,000	\$1,600 to \$4,000	yes
R 3	Riparian	Inspect for annual damage, pest, disease and treat or remove as required	Moderate	annual	2	Initial + on-going maintenance	\$2,500 to \$4,000	\$1,200 to \$2,400	no
R 4	Riparian	Remove downed materials in stream to reduce flooding	High	annual	.3 Moderate	Initial + on-going maintenance	\$3,000 to \$15,000	\$1,500 to \$15,000	yes
R 5	Riparian	Manage invasive non-native species for ecological restoration	Moderate	annual	2.1 Heavy	Initial + on-going maintenance	\$9000 to \$15,000	\$3,000 to \$5,000	yes
R 6	Riparian	Remove mature acacia + seedlings varying from 2"-24" diameter from east bank of Cerrito Creek	low	annual	<0.1 Heavy	On-time + follow up	\$15,000 to \$25,000	\$1,500 to \$5,000	follow-up

End Notes

- i Havlik, Neil. "The Story of Albany Hill." Freemontia. The California Native Plant Society Newsletter. October 1972, pp. 8-9.
- ii Routley, J. Gordon. The East Bay Hills Fire Oakland-Berkeley California. US Fire Administration Technical Report Series. USFA-TR-060/ October 1991. Pg 2.
- iii Bay Area Early Detection Network at <http://www.baedn.org/>. "Invasive species have profound impacts worldwide on the environment, economies, and human health including:
- The replacement of dominant native species (Tilman 1999)
 - The loss of rare species (King 1985)
 - Changes in ecosystem structure, alteration of nutrient cycles and soil chemistry (Ehrenfeld 2003)
 - Shifts in community productivity (Vitousek 1990), reduced agricultural productivity, and changes in water availability (D'Antonio and Mahall 1991)
- Detection/Rapid Response is a cost-effective approach for managing harmful invasions while preventing economic and environmental harm. EDRR is a system for solving tomorrow's problems today and is widely considered the best approach for coping with infestations of harmful species. In California, BAEDN aims to build an effective network serving the nine counties of the San Francisco Bay Area, and to work with neighboring regions to build an integrated system of EDRR networks covering the state.
- iv Ertter, Barbara, PhD. Seasonal Work Schedule. Undated
- v Bush, 2006. Grazing Handbook: A Guide for Resource Managers in Coastal California. Sotoyome Resource Conservation District. Santa Rosa, CA 68 pp. <http://sotoyomercd.org/GrazingHandbook.pdf>. Accessed 7/21/2011.

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Vegetation Management Plan
Albany Hill and Creekside Park

Appendices

THE CODE OF THE CITY OF ALBANY

COUNTY OF ALAMEDA
STATE OF CALIFORNIA

1988

Amended through June 7, 2011

CHAPTER XI FIRE PREVENTION

11-1.2 Weed Abatement.

The annual weed abatement program will be administered by the Fire Marshal or other designated member of the Fire Department. (Ord. #91-02, §§1, 2)

11-2.3 Fire Extinguishing Systems.

g. *Vegetation Management.*

All weeds growing upon the streets, sidewalks or upon private property within the City of Albany, which attain such a large growth as to become a fire menace when dry, or which are otherwise noxious or dangerous, and all accumulated debris on property, are declared to be a public nuisance. The Fire Marshal or his/her designee shall notify the property owner in writing of said dangerous accumulations which must be abated by the removal of all debris and weeds or grass in a thirty (30) foot strip adjacent to all improvements and other requirements per NFPA 1144 to maintain a defensible space.

(Ord. #94-010, §§1-7; Ord. #96-08, §§2-8; Ord. #96-011; Ord. #97-09, §§2, 3; Ord. #07-07, §11)

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30 August 2011

Cheryl Miller, RLA
3311 39th Ave.
Oakland, CA 94619

RE: Review of Vegetation Management Plan for Albany Hill and Creekside Park in Albany, CA

Dear Cheryl:

This letter reports the findings of my recent habitat assessment survey at the above-referenced site as a winter roosting site of the Monarch butterfly (*Danaus plexippus*) and review of the preliminary draft (dated 8-5-2011) of the Vegetation Management Plan for Albany Hill and Creekside Park. In addition, general background information on the winter roosting habitat for the Monarch and preliminary recommendations for project planning are presented.

Background Information on the Monarch Butterfly and its Winter Roosting Habitat.

Monarchs cannot survive the colder winter months of most parts of North America. For this reason, they travel to their wintering areas during the fall months of each year. Monarchs that live west of the Rocky Mountains migrate to coastal areas of California, while those that live east of the Rockies travel to a few sites in the mountains of Central Mexico. In coastal California, winter roosting sites range from northern Baja California to southern Mendocino County. Most winter roosting sites in California are usually located within 0.5 to 1 mile of the coast (Weiss et al. 1991, Nagano and Lane 1985).

Along the Alameda County coastline, there are about 10 locations of Monarch winter roosts between Fremont and Albany and in nearby western Contra Costa County (Nagano and Lane 1985; California Natural Diversity Data Base 2011). In the late 1990's Albany Hill had an estimated 3,000 overwintering Monarchs, but in more recent years the observed numbers have been in the range of a few to several dozen individuals (Xerces Society, www.xerces.org).

In California, clustering behavior begins once migrating Monarchs reach their overwintering sites in the fall. Two types of clustering occur:

- a) temporary aggregations that are transient clusters of short duration; and
- b) permanent roosts that are long term (past the winter solstice) hibernal clusters which also possess the environmental conditions that allow the butterflies to mate in January and February before their spring dispersal (Urquhart 1960).

I spoke with Carole Fitzgerald, who has monitored the Monarchs at Albany Hill for many years, and confirmed that the overwintering habitat there is a permanent roost site for Monarchs.

In the fall months, typically in September and October, numerous, generally small temporary aggregations are formed, especially in areas where nectar plants are plentiful near the coast. These temporary aggregations in the fall are also referred to as autumnal roosts or clusters. Monarchs at many of these sites disperse to permanent roosting sites as nectar sources, air temperature, and day length decrease. Some sites may serve as permanent roosts one year and temporary aggregations another year, or a mixture of the two. Also, some locations may occasionally not be used for either purpose. The permanent roosts are also referred to as winter roosts. Thus, overwintering habitat for the Monarch consists of autumnal and winter roost trees, plus surrounding trees that provide primary and secondary wind protection, as well as sources of nectar and water. Because the Monarchs often fly some distance from the roost trees to obtain nectar and water, existing residential and even urban areas can be part of the butterfly's overwintering habitat.

Overwintering sites are characterized by groves of trees of mixed height and diameter, with an understory of brush. Often there is a small clearing within a stand of trees, or formed by a combination of the trees and surrounding topography, to provide shelter for the butterfly. These locations are usually characterized by south or southwestern aspects. These overwintering sites protect the butterfly from prevailing on-shore winds and freezing temperatures, plus exposure to the sun. The vegetation serves as a thermal "blanket" which moderates extreme weather conditions (Calvert and Brower 1982). At some locations, nearby buildings may provide some protection as well.

Recent research has demonstrated that forest canopy structure is a primary determinant of microclimatic conditions in forest stands, and is undoubtedly an important factor in the Monarch's selection of particular locations as overwintering roosts (Bell 1997; Leong 1990; Sakai et al. 1989; Weiss et al. 1991). Many of the best overwintering sites provide a heterogeneous mixture of habitat conditions and resultant microclimatic conditions that assist the Monarchs to survive seasonal changes in climatic conditions during the winter. For example, overwintering habitats must provide wind protected roost locations (usually tree branches that are 15-50 feet above ground), with buffered temperatures, relatively high humidity, and filtered sunlight throughout the fall and winter months. As weather conditions and exposure to sunlight vary over the winter months, high habitat heterogeneity at an overwintering site permits the Monarch roosts to satisfy their thermoregulatory needs by moving from tree to tree in response to changes in weather conditions. Thus during the early part of the overwintering period (October – November), when daily temperature maxima are relatively high, Monarchs tend to cluster in locations that provide brief morning insolation, with mid-day and afternoon shade. Later in the season (December – February), when temperature maxima are lower, they tend to roost in trees that receive afternoon sunlight. Trees surrounding roost locations, known as windbreak or buffer trees, provide both wind protection and ameliorate microclimatic conditions near the roost trees. Buildings can also afford wind protection depending upon their height and locations relative to the roost trees.

A number of cluster sites in coastal California are located in groves of introduced trees. Favored trees for Monarch roosts include, Blue Gum (*Eucalyptus globulus*), River Gum (*E. camaldulensis*), Monterey Pine (*Pinus radiata*), and Monterey Cypress (*Cupressus macrocarpa*), although a number of other native and introduced species of trees are also utilized (Lane 1993).

Clusters typically form between about 15 and 50 feet above ground, but have been observed as low as 6 feet and as high as 75 feet.

Cluster sites are protected from winds by a combination of tree cover (i.e., spatial configuration and density) and topography. Gullies, canyons, creek embankments, and the lee sides of hills are areas where Monarchs will roost, if the appropriate tree cover is present. Although the butterflies are inactive on colder, rainy, or foggy days, they will fly from the cluster on warmer, sunny days to obtain the water and nectar that are needed to sustain the butterflies through the winter. Thus, a nearby source of water and an abundance of fall and winter-blooming nectar plants are also important factors in determining where the butterflies will roost. Monarchs can obtain water from natural or man-made bodies of water, runoff from sprinklers, and dew on vegetation (Nagano and Lane 1985). Important nectar plants at many winter roosting sites include, *Eucalyptus* trees, Coyote Bush (*Baccharis*), English Ivy (*Hedera helix*), wild mustard (*Brassica*), and Bottlebrush (*Callistemon*), although other native and introduced species, including fall and winter flowering ornamentals, will be used if they have the appropriate floral morphology.

In concluding this discussion, I would like to emphasize that although a number of basic features are important determinants in the suitability of a particular location to serve as an overwinter roosting site by the Monarch butterfly, there is also an interaction of these and other factors that are not yet understood by researchers. Also, because features of a site can change rather quickly due to the growth of trees and understory vegetation, thinning or removal of trees, removal of brush, changes in nectar plant abundance, etc., Monarch visitation at a particular site may vary from year-to-year and for longer durations. Indeed, new roosting sites continue to be discovered in California as conditions become favorable, even in areas where roosts were not previously observed. Similarly, when habitat quality deteriorates at locations that previously supported winter roosts, Monarchs will cease to roost at these sites. Clearing of brush and thinning of trees are common vegetation management practices that have adversely impacted Monarch roosting sites, even on public lands (Nagano and Lane 1985; Weiss et al. 1991).

SURVEY METHODS

I met you and botanist, Kathy Lyons, at Albany Hill on 24 August 2011, and surveyed the entire site by walking throughout it and by driving and walking throughout the surrounding neighborhood. During my survey of Albany Hill and the surrounding residential neighborhood, I noted the presence of various plants and features that are known to be important to the Monarch butterfly at occupied overwinter roosting sites (see Background Information). In particular, I searched for the favored trees that are used as roosts, examined the spatial configuration and density of favored trees, vegetation structure, sheltered areas within the groves of roosting trees, trees that provide primary and secondary wind protection, nectar plants, and water sources.

RESULTS AND DISCUSSION

According to Carole Fitzgerald, the primary Monarch roosting area is an opening in the eucalyptus forest on the southwestern slope of Albany Hill. This roost area is actually located outside of the park's boundaries on property owned by the Golden Gate Hill Development

Company. Roosting Monarchs have also been observed on the western and northwestern slopes, near the ridge top, in some years. Carole also noted that she has seen Monarchs nectaring in the grassy area near the cross, but did not recall the plants that were visited.

The proposed goals of the Vegetation Management Plan focus on removing non-native plants, fire prevention, and reducing fuel loads. These goals would be accomplished using a variety of techniques, including but not limited to:

- a) removal of various invasive trees, shrubs, and herbaceous plants such as Monterey Pines, Acacias, broom, cotoneaster, pampas grass, poison hemlock, and thistles;
- b) reduction of ladder fuels;
- c) removal of hazard trees;
- d) selective tree thinning to create vertical separation between the canopy and surface fuels and to reduce fuel loads;
- e) thinning, height reduction, and removal of understory brush; and
- f) mowing of grasses and other herbaceous vegetation.

As I hope should be evident from the Background Information section, implementation of all of these proposed vegetation management activities could alter habitat values to such a degree that Monarchs would not be able to overwinter at Albany Hill. Potential impacts may include removal of nectar plants and reduction of primary and secondary wind protection. Dew drops on the foliage are often used as a water source by overwintering Monarchs. Also, because Monarchs generally roost between 15 – 50 feet above ground, the creation of vertical separation between surface fuels and tree canopies could even include removal of or modifications to roost areas.

That said, I also understand the desire of residents and city staff to implement some appropriate fire prevention measures; however, if retention of overwintering Monarchs remains a primary goal of the Vegetation Management Plan, then the fire prevention actions need to be focused in portions of Albany Hill where these deleterious impacts to the Monarch will not occur. At other Monarch roosting sites even seemingly minor changes in vegetation structure, have degraded habitat conditions for the butterfly and in a few instances rendered a site unusable.

I should note that I have not been to Albany Hill when Monarchs are present, so I am not familiar with all of the specific locations where the butterflies roost, nectar, and obtain water. For this reason, it would be useful to conduct a survey of the overwintering Monarchs this fall and winter to see where they these activities occur and how they utilize other portions of Albany Hill and Creekside Park. Armed with such information, I would be better able to identify specific locations where the invasive plant removal, fire prevention, and fuel reduction activities could be implemented without harming the Monarch or its overwintering habitat.

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If you have any questions about my report, please contact me.

Sincerely,



Richard A. Arnold, Ph.D.
President