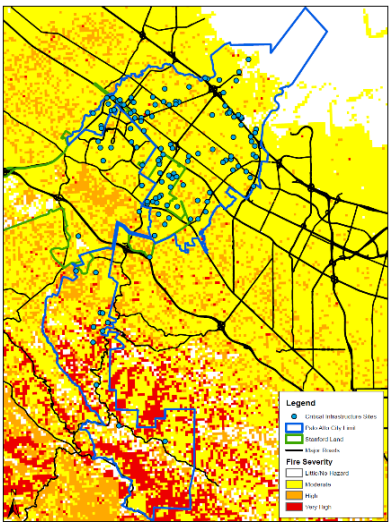
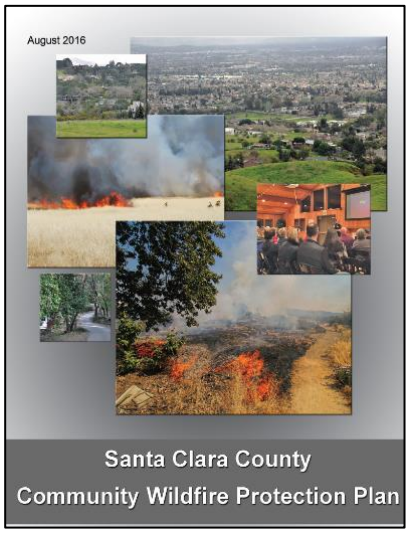
FOOTHILLS FIRE MANAGEMENT PLAN

CITY OF PALO ALTO



Midpeninsula FireSafe COUNCIL



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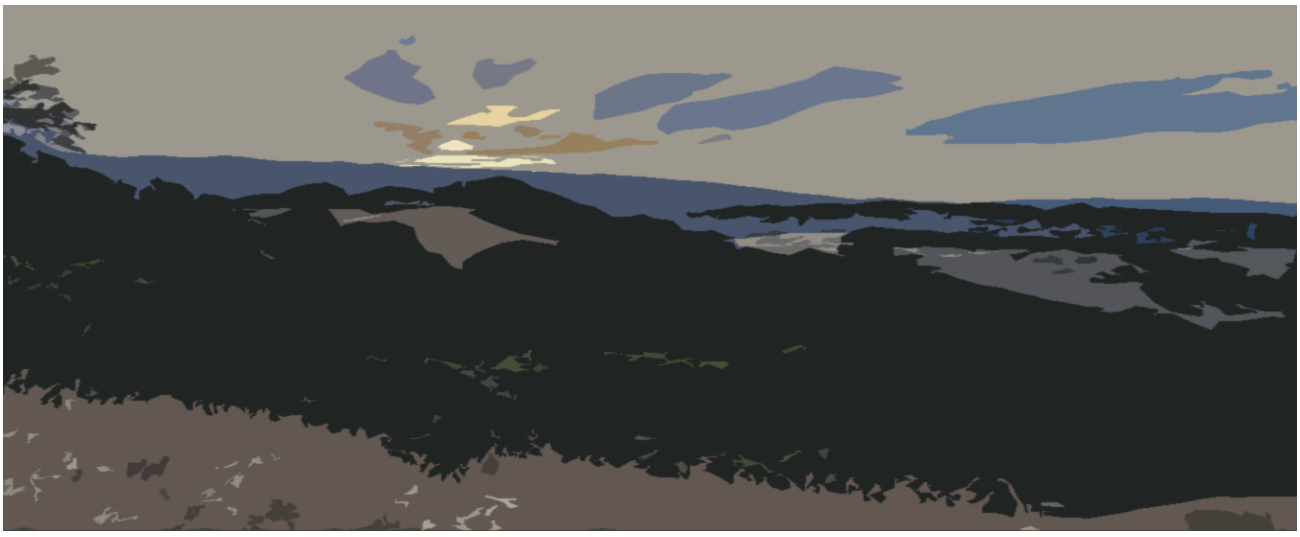
2016 UPDATE



Acknowledgements

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Image 1: Palo Alto FIre Department Brush Rig Patrolling Trapper's Trail

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Image 2:Treated area in Foothills Park

Executive Summary

The 2009 Foothills Fire Management Plan (FFMP) addressed a broad range of integrated activities and produced planning documents to address and mitigate the impacts of fire hazards in the Palo Alto Foothills Area. The area of interest includes the areas west of Foothills Expressway to the city limits of Palo Alto.

The FFMP addressed fire hazard assessment and regional evacuation routes, wildland fire management recommendations and mitigations. The FFMP also reviewed non- project related topics such as Municipal ordinances related to wildland fire and recommended staffing levels for Station 8 in Foothills Park. It proposed an implementation plan and identified potential funding, and included CEQA documentation for the proposed projects. Last, it recommended updates to the Pearson-Arastradero Trails Master Plan and Foothills Trail Maintenance Plan.

This 2016 FFMP update focuses on topics directly related to fire hazard mitigation, emphasizing project-related improvements. This program is also documented in the City of Palo Alto Local Hazard Mitigation and Adaptation Plan (LHMAP) and demonstrates how the City mitigates wildfire risk through the implementation of projects in the FCWPP.

This update provides a description of significant accomplishments achieved since 2009 in the areas of treatment of evacuation routes, prescribed fire and associated containment lines, and residential boundary treatments (mowing, disking). Program costs are also provided showing how allocated funds were used. City funding since 2009 has totaled $452,332.

A post treatment fire behavior assessment is also included in this update to describe the threat but also to identify areas of future treatments. The most important benefit has been an increased ease of evacuation and emergency access through the expansion of managed roadside vegetation. The roadsides along Arastradero Rd, Los Trancos Rd and Page Mill Rd are all safer for access and egress through increased line of sight, reduced fuel volumes and reduction of ladder fuels. The probability of ignitions has been reduced through a reduction of fuels near barbeques and structures, and along roadsides. The potential for containment of a wildfire (both within the parks, and between City property and neighbors) has been enhanced through the creation, maintenance, and enhancement of reduced fuel zones. These treatment areas are strategically placed along property perimeters and ridgelines.

The update also incorporates the participation in the county-wide Community Wildfire Protection Program (CWPP), which includes a Palo Alto/Stanford annex.[1] The county CWPP project began after the initiation of this planning update, but future updates will be transitioned to the Palo Alto/Stanford Community Wildfire Protection Plan on a five year update cycle.

Foothills Fire Management Plan Update Process

The 2009 Foothills Fire Management Plan (FFMP) addressed a broad range of integrated activities and produced planning documents to address and mitigate the impacts of fire hazards in the Palo Alto Foothills Area. The area of interest includes the areas west of Foothills Expressway to the city limits of

[1] The Santa Clara County Community Wildfire Protection Program (CWPP) is a collaborative approach for reducing wildland fire risks to communities and the environment. The plan includes an analysis of conditions such as fire apparatus access, community evacuation, fuels, topography, and weather. The plan also includes proposed projects developed through the workshops. http://www.sccfd.org/santa-clara-county-community-wildfire-protection-plan

Palo Alto.

The 2009 Plan addressed fire hazard assessment and regional evacuation routes, wildland fire management recommendations and mitigations. The FFMP also reviewed non-project related topics such as Municipal ordinances related to wildland fire and recommended staffing levels for Station 8 in Foothills Park. It proposed an implementation plan and identified potential funding, and included CEQA documentation for the proposed projects. Last, it recommended updates to the Pearson-Arastradero Trails Master Plan and Foothills Trail Maintenance Plan.

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Accomplishments

Since the Foothills Fire Management Plan was adopted in Jan 2009 significant progress has been made. Perhaps two of the most significant accomplishments have been advances in organization and relationships.

The City will be taking an additional step to adopt the FFMP as a Community Wildfire Protection Plan. With a Community Wildfire Protection Plan (CWPP), the City is in a better position to receive grants from Federal or State funding sources. Because the FFMP satisfied the requirements of a CWPP, the City was able to simply obtain an approval signature from the local CAL FIRE representative and send it to the California Fire Alliance where it became official.

Another significant advance was the development of an ongoing relationship with the Santa Clara County Fire Safe Council (SCFSC). The City developed a 5-year Stewardship Agreement with the SCFSC to help implement the FFMP/CWPP. An annual work plan is mutually agreed-upon, based on availability of funding and capacity of the SCFSC. The SCFSC typically supervises and pays for CAL FIRE hand crews to reduce fuels along roads and in say Foothills Park and Pearson-Arastradero Preserve, and provides community outreach and education programs in the City regarding wildland fire.

A novel organizational strategy was adopted which recognizes that the FFMP involves and requires support from many City Departments. While the program originated in the Fire Department, the Public Works Department, Office of Emergency Services and Community Services Department are all key to the success and beneficiaries of the projects. As such, representatives of each of these four departments meet regularly (generally quarterly, but sometimes more often) to strategize effective actions. The Chair of this inter-departmental group rotates between the departments. Funding is pooled from all four departments based on the anticipated costs of performing fire hazard reduction work under their responsibility. For example, roadside treatments on public right-of-ways are funded by Public Works whereas evacuation treatments along roads inside parks are funded by the Community Services Department.

Through efforts and funding of the City and with support of the SCFSC, many on-the-ground projects

have been completed, resulting in reduced risk of damage from wildfire and safer evacuation routes and emergency access. While the relationship with the SCFSC has been a major benefit to the program, the City Parks and Recreation staff support has also been essential and effective. Coordination of equipment use and storage, as well as assistance in observing conditions on the ground has greatly bolstered the effectiveness of the SCFSC efforts.

Spatial information, encompassing the planning and monitoring of work location, costs, and schedule has been aided by the collection of project boundaries and associated data through the use of a geographic information system (GIS). Both Google Earth and ESRI-based software compatible with the City of Palo Alto GIS were used. Planning, analysis and project organization is currently done with digital spatial files.

Outreach and education regarding fire hazards in the Foothills has been accomplished in concert with the SCFSC. For example, when the City Office of Emergency Services hosted an educational event the local SCFSC manager provided a presentation regarding vegetation management and fire safety. More recently, the SCFSC has coordinated resident-contractor efforts to reduce vegetative fuels along Los Trancos Road on both public right of way and private yards, with debris disposal provided by Woodside Fire Protection District.

Treatment of vegetation during the previous 5 years in the Foothills has been ambitious. In addition to the annual mowing and disking, and periodic treatments of trappers Trail, many areas that had not been treated in several years, were tackled. In some locations treatment areas were widened or otherwise expanded. Details of the program accomplishments appear in Appendix A, but a synopsis follows:

- Treatment of evacuation routes within City boundaries on public roads
    - Pearson-Arastradero Rd.
    - Page Mill Rd.
    - Los Trancos Rd.
- Treatment of evacuation routes within City parks
    - Wild Horse Valley leading to Towle Campground
    - Foothill Park from Maintenance Yard to Gate
    - Foothill Park to Hewlett Property
- Prescribed Fire and Associated Containment Lines
- Residential boundary treatments (mowing, disking)
    - West and East of Pearson-Arastradero
    - South of residents on Foothill Park (NE of gate)

Post-Treatment Fire Behavior

As a result of the implementation of the FFMP/CWPP the fire behavior has changed, with several concrete benefits. The most important benefit has been an increased ease of evacuation and emergency access through the expansion of managed roadside vegetation. The roadsides along Arastradero Rd, Los Trancos Rd and Page Mill Rd are all safer for access and egress through increased line of sight, reduced fuel volumes and reduction of ladder fuels. The probability of ignitions has been reduced through a reduction of fuels near barbeques and structures, and along roadsides. The potential for containment of a wildfire (both within the parks, and between City property and neighbors) has been enhanced through the creation, maintenance, and enhancement of reduced fuel zones. These treatment areas are strategically placed along property perimeters and ridgelines.

A spatial depiction of the change in fire hazard is presented by maps in Appendix E. The fire behavior

modeling used FlamMap, based on LandFire data and modified through a series of decision-rules applied to treatment areas. For example, places that were covered with shrubs and chaparral under oak woodlands that were treated near roads were changed to a fuel type that typifies an oak woodland with an open understory. Details regarding the fire behavior modeling process and results appears in Appendix E.

New Recommendations

As with most vegetation management projects, the initial treatments require the most substantial effort; maintenance tends to require less of an effort. Initial treatments have been done in most locations, and are in "maintenance mode". While Appendix A describes the areas successfully treated (many which require annual treatments), it also lists areas not treated, and Appendix B recommends new areas to be treated. Since vegetative growth is cyclical and highly dependent on environmental factors, the planning team will conduct annual assessments to determine the areas to be treated and the level of effort that provides the highest benefit for the current costs of treatment.

Because of the success in treating areas identified in the FFMP, new and additional areas have been identified for treatment, based oncurrent hazardous conditions as demonstrated in a fire behavior analysis, and potential benefit to the City and region as observed by staff.

Details of new, additional recommended projects appear in Appendix B. The most significant additional new treatment area is the east side of Page Mill Road within the City boundaries and owned by Mid–Penninsula Open Space District (MROSD). Other new treatment areas are within City Parks. The most significant project aimed at residents will be an endeavor to designate the Foothills of Palo Alto as a FireWise Community.

A few locations have been removed from the list of projects recommended for treatment, or the areas have been reduced in size, due to changing landownership, staffing duties and fuel conditions. These generally occur within Pearson-Arastradero Park, and do not result in a significant decrease in hazard. These treatment areas are detailed in Appendix C.

Program Costs

The initial 5-year cost of the program was estimated at $700,000. City funding since 2009 has totaled $452,332. Costs for hand crews was greatly reduced through the use of California Department of Corrections) CDC road crews under supervision of CAL FIRE and the SCFSC, whereas costs for contracted hand crews was much greater than estimated. Overall, the costs of implementation are approximately 20% higher than estimated.

Future costs of the program are estimated to be relatively stable or slightly higher because of the reduced costs associated with maintenance as compared with initial treatment, balanced with higher contract mowing costs. Some areas (such as defensible space treatments) will require annual treatments, and some areas, such as Trappers Trail, require periodic treatment on a longer interval. Estimated projected costs appear in Appendix D. The continued relationship with the SCFSC has provided funding for projects through their partners. For example, funds from PG&E for treatment of areas within 1000 feet of powerlines on Page Mill Road will augment SCFSC funds dedicated for that area. Similarly, grants and funds from partners are expected to be aimed at additional eucalyptus management on Stanford lands within the City. Costs are explained in Appendix D.

- As previously mentioned, the Santa Clara County Fire Department has prepared a county-wide

Community Wildfire Protection Plan, and local planners have incorporated the FFMP into this plan. This strategy has several benefits; one primary benefit is to become eligible for a broader suite of funding sources through grants associated with regional efforts. The City also can:

- Retain its site-specific project recommendations within the CWPP
- Retain autonomy in implementation of desired projects
- Be consistent with the City's and Region's Local Hazard Mitigation Plans
- Leverage community outreach through regional meetings and solicitation of input
- Build on the County-wide assessment fire hazard in residential areas that are specific to Palo Alto

APPENDICES

Appendix A. Treated Areas

Map 1. Projects Completed

Appendix B. New Treatment Areas and Activities

Map 2. Recommended Projects

Appendix C. Treatment Areas to be Abandoned or Revised

Map 3. Projects to be Abandoned

Appendix D. Program Costs

Table 1. Entity Responsible for Treatment

Appendix F. Technical Report: FlamMap Fire Behavior Results for Palo Alto

Image 3: Mowing to reduce brush along evacuation routes

APPENDIX A. Treated Areas

There area treated within the previous 5 years under the FFMP is expansive. This list indicates the locations where treatment has occurred, organized by the objective served from treatments. The locations of these treated areas is shown on Map 1, following this list.

Designation	Project	Description	Source of Work	Dates Completed
Life Safety				
Foothills Park				
F.F1	Firefighter Safety Zone 1	Trappers Ridge & Los Trancos Trail	Mowing Contract	annually
F.F2	Firefighter Safety Zone 2	Trappers Ridge & Madrone Fire Road	Mowing Contract	annually
F.F3	Firefighter Safety Zone 3	Trappers Ridge high point	Mowing Contract	annually
F.F4	Firefighter Safety Zone 4	Trapper Ridge south end	Mowing Contract	annually
F.E1	Evacuation Route - Page Mill Road	Within PA City from Arastradero to southern Pony Tracks	SCCFSC - CDCR	2015+16
F.E2	Evacuation Route - Park Road	Entrance to Maintenance Yard to Las Trampas Valley	SCCFSC - CDCR	2015+16
F.E3	Evacuation Route - Park Northwest	Interpretive Center to the 600-700 block of Los Trancos Road	Not completed	
F.E4	Evacuation Route - Park Northeast	Boronda Lake to Alexis Drive	Not completed	
F.E5	Secondary Evacuation Route - Wildhorse Valley	Wildhorse Valley from Towle Campground to Las Trampas Valley	SCCFSC - CDCR	2015
Pearson-Arastradero				
A.E1	Evacuation Route – Arastradero Road	Arastradero Road		2015+16
Off-site				
PA.1	Evacuation Route Page Mill Road	From Foothill Park South to Skyline Rd	SCCFSC – CDCR	2015+16
PA.2	Evacuation Route Arastradero Road	From Page Mill to Arastradero Pk, and from Arastradero Pk to Los Trancos	SCCFSC - CDCR	2015+16
PA.3	Evacuation on Los Trancos Road between Santa Clara County boundary and Oak Forest Court	Also noted as FE6	SCCFSC – CDCR + Contractor	2015+16
PA.4	Evacuation Route Skyline Blvd.	Skyline Blvd.	SCCFSC - Contractor	2015
Structure and Infrastructure Protection				
Foothills Park				
F.D1	Defensible Space	Entry Gate and Restroom	SCCFSC - CDCR	annually
F.D2	Defensible Space	Station 8	Fire Dept	annually
F.D3	Defensible Space	Restrooms at Orchard Glen	SCCFSC - CDCR	annually
F.D4	Defensible Space	Interpretive Center	SCCFSC - CDCR	annually
F.D5	Defensible Space	Maintenance Shop Complex	SCCFSC - CDCR	annually
F.D6	Defensible Space	Boronda Pump Station at Campground	SCCFSC - CDCR	annually

Designation	Project	Description	Source of Work	Dates Completed
F.D7	Defensible Space	Park Tank	SCCFSC - CDCR	annually
F.D8	Defensible Space	Boranda Water Tank	Not completed	
F.D9	Defensible Space	Dahl Water Tank	SCCFSC - CDCR	annually
Pearson-Arastradero				
A.D1	Defensible Space	Gateway Building and Restrooms	Acterrra, Parks Staff	annually
A.D2	Defensible Space	Pump Station	Parks Staff	annually
A.D3	Defensible Space	Corte Madera Water Tank	SCCFSC - CDCR	annually
A.D4	Defensible Space	Western Water Tank	SCCFSC - CDCR	annually
Ignition Prevention				
Foothills Park				
F.I1	Ignition Prevention	Lakeside Picnic Area	SCCFSC - CDCR	annually
F.I2	Ignition Prevention	Shady Cove Picnic Area	SCCFSC - CDCR	annually
F.I3	Ignition Prevention	Encinal and Pine Gulch Picnic Areas	SCCFSC - CDCR	annually
F.I4	Ignition Prevention	Orchard Glen Picnic Area	SCCFSC - CDCR	annually
F.I5	Ignition Prevention	Oak Grove Group Picnic Area	SCCFSC - CDCR	annually
F.I6	Ignition Prevention	Towle Camp	SCCFSC - CDCR	annually
Containment				
Foothills Park				
F.C1	Containment	Trappers Trail	Mowing Contract	2015
F.C2	Containment	Pony Tracks south of Trappers Ridge	Mowing Contract	2015
F.C3	Containment	Pony Tracks north of Trappers Ridge	Mowing Contract	2015
F.C4	Containment	Bobcat Point	Not completed	2015
F.C5	Containment	North of Entry Gate	Not Completed	2015
F.C6	Containment	Valley View Fire Road	Not Completed	2015
Pearson-Arastradero				
A.C1	Containment	Property boundary adjacent to Liddicoat	Park Staff	annually
A.C2	Containment	Property boundary adjacent to Stanford and Portola Pastures	Not completed	
A.C3	Containment	Redtail Loop Area	Not completed	
A.C4	Containment	Property boundary adjacent to Paso del Robles	Park Staff	annually
A.C5	Containment	Property boundary Laurel Glen - north	Not completed	
A.C6	Containment	Property boundary Laurel Glen - south	Not completed	
A.C7	Containment	Property boundary west of Meadow Lark Trail	Not completed	
A.C8	Containment	Property boundary adjacent to former private research facility	Not completed	

Designation	Project	Description	Source of Work	Dates Completed
A.C9	Containment	Property boundary adjacent to John Marthens Lane	Park Staff	annually
A.C10	Containment	Arastradero Creek (to Juan Bautista trail)	Not completed	
A.C11	Containment	Meadow Lark to Juan Bautista Trail	Park Staff	annually
A.C12	Containment	Meadow Lark south	Not completed	
A.C13	Containment	Bowl Loop Trail	Not completed	
A.C14	Containment	Arastradero to Rx fire area	Park Staff	Annually
A.C15	Containment	Acorn Trail	Not completed	
A.Rx1	Containment	Juan Bautista Prescribed fire north	Fire Department	2013
A.Rx1	Containment	Acorn Trail Prescribed fire south	Not completed	

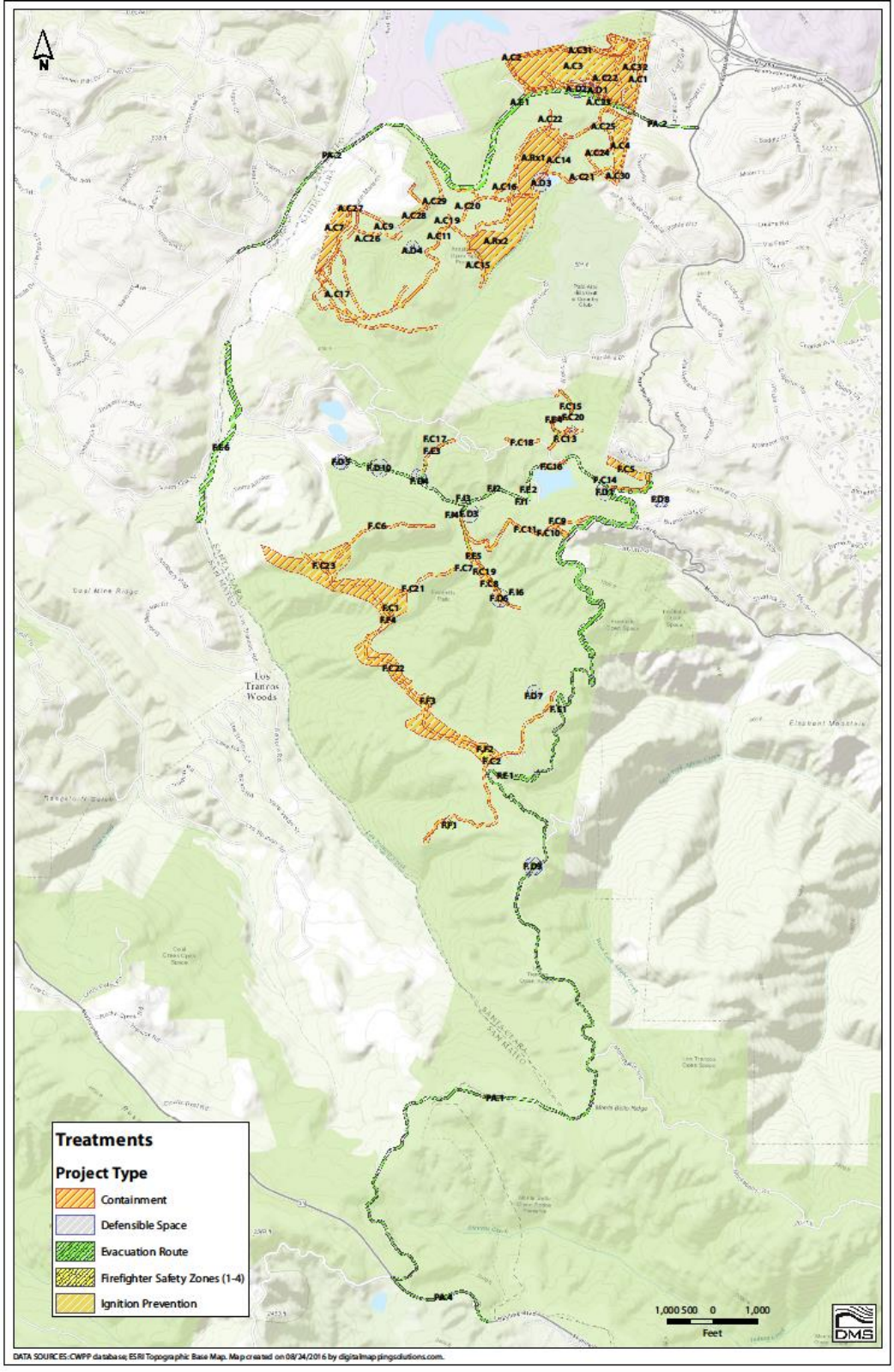
Unmapped Treatment Areas

This update also captures areas not delineated in the 2009 FFMP but are regularly treated. These consist of strips of land disked and mowed to create firebreaks.

The locations of these treatment areas previously unmapped are included in the map on the following page:

Appendix A Projects Completed

Palo Alto, California
Santa Clara County



APPENDIX B. New Treatments Areas and Activities

New Treatment Areas

There are six new treatment areas:

New Treatment Area #1	Area south of the Maintenance Yard in Foothills Park
PA1 Expanded	The other side of Page Mill Road managed by MROSD
PA1 Expanded	Work in the roadside right of ways (as contrasted with the fuelbreak off the right of way)
New Treatment Area #2	Areas under and near powerlines on City land following Wild Horse Fire Road (some has already been treated, some offset from treatment area)
New Treatment Area #3	Areas under and near powerlines on City land following Wild Horse Fire Road (some has already been treated, some offset from treatment area)
Eucalyptus Grove #1, #2, #3	Eucalyptus removal on upper Page Mill Rd.
New Treatment Area #5 and #6	Connection between Madrone Fire Trail, and Valley View Fire Rd and Wild Horse Fire Road
Stanford Land Eucalyptus Removal	Treat and otherwise address eucalyptus north and west of Atrastradero Park because these fuels could be ember producer under north wind to Palo Alto property. Options include thinning and removing the trees over several years. The treatment area covers the stable, Ranch and Stanford properties, within City limits.

The locations of these new treatment areas are shown on Map 2.

New Activities

Summary - In addition to new areas of treatment areas, a suite of new activities is recommended. Some of the activities either are to be applied throughout the FCWPP area, some in the residential areas within the FCWPP, and one is specific to along Los Trancos Road. These activities include:

1. Preparation of an application to become a FireWise Community,
2. An assessment of fuels (residential and wildland fuels)
3. Incorporation of the FCWPP into the Local Hazard Mitigation Plan and Comprehensive Plan, and
4. Increased collaboration on Los Trancos roadside treatments.

Firewise Community Application - The following are requirements to qualify as a Firewise Community:

1. Create an agreed-upon, area-specific action plan for the community, to be approved by the California Firewise representative.

2. Hold a Home Ignition Zone Workshop to present the results of the assessment to the homeowners and motivate them to become involved in project planning and participation in a Firewise Board (or similar decision-making body).

3. Create an Action Plan that comprises the recommended steps homeowners can take to increase the fire safety in their neighborhood, based on the assessment and willingness of the homeowners. These will include at least three agreed-upon, doable action items that will improve the site's wildfire readiness

4. Form a Firewise Board, which could be a subset of the MidPeninsula FireSafe Council, or another existing organization serving the emergency preparedness needs of the neighborhood.

5. Hold a Firewise Day event - an informative and social event of the neighborhood that provides an opportunity to distribute material and build community spirit and pride. This could be held in conjunction with a HOA annual meeting. The event could include a firewise landscaping walking tour of the neighborhood, and a nursery demonstration or exhibit. Alternatively, the event could include the cost of a crew to assist Juniper removal and chipping during the day.

6. Invest a minimum of $2/capita in local wildfire mitigation projects. (Volunteer hours, equipment use, time contributed by agency fire staff, and grant funding can be included)

7. Submit an application, working with a HOA representative.

8. Develop a Community Success Story, detailing the process, participants and activities will be documented via photographs and short text so that the material can be posted on the City's website or other outlets (such as FireWise USA website).

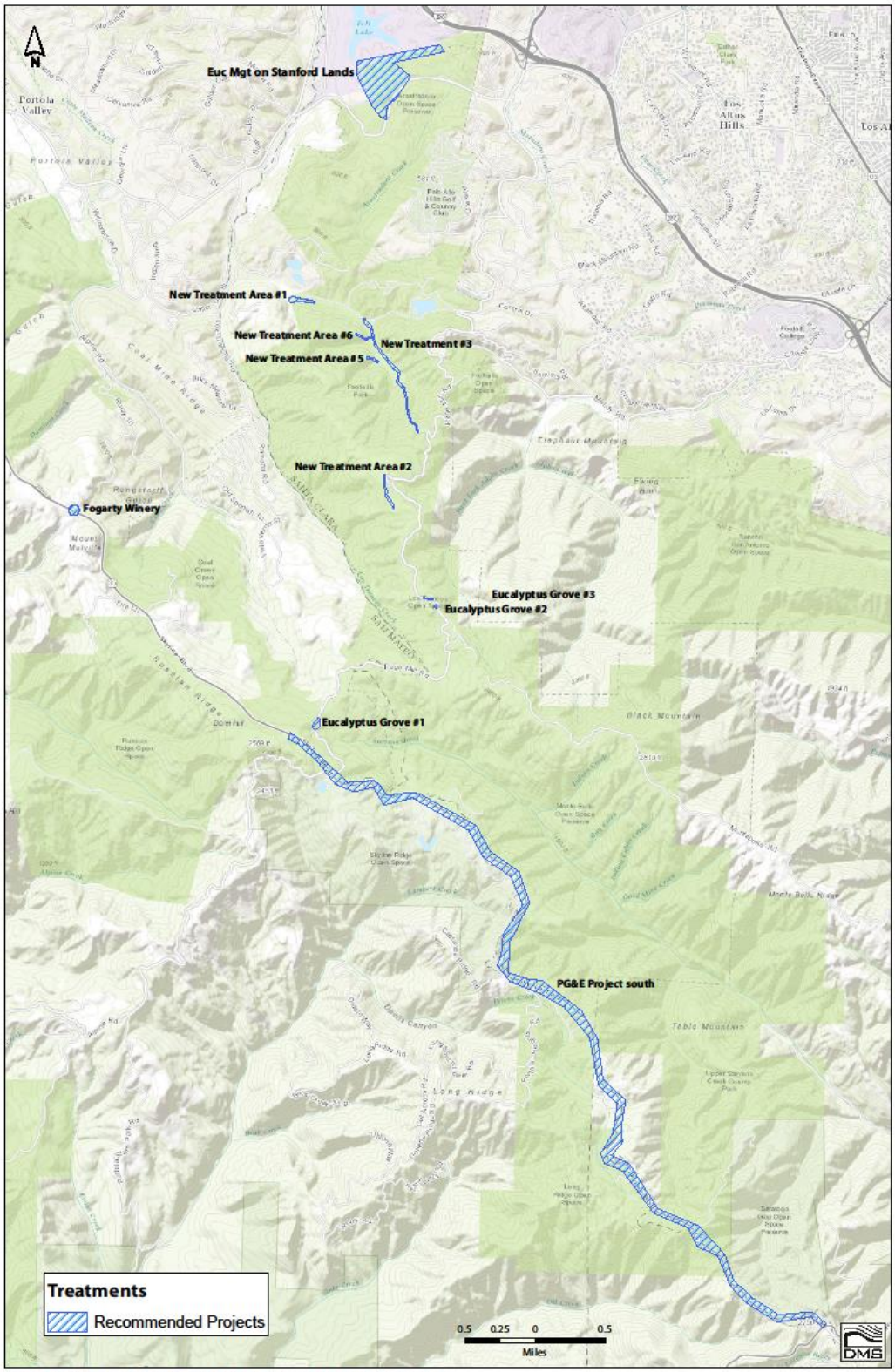
Fuels Assessment – Part of the Firewise Application would include an assessment of vegetative and structural fuels in the area encompassed by the application. In addition, wildland fuels analysis would be characterized.

Including the FCWPP into the Local Hazard Mitigation Plan and Comprehensive Plan – It is recommended that this update and the contents of the county-wide CWPP serve as the wildfire component of Palo Alto Local Hazard Mitigation Plan (LHMP) and General Plan - Safety and other element amendments.

Los Trancos Roadside Treatments – This project is involves increased collaboration with Woodside Fire Protection District, neighbors along Los Trancos Rd, and Santa Clara FireSafe Council to treat a wider width of vegetation along Los Trancos Road (F.E6). The SCFSC will coordinate contractors to perform the work along the road and perform outreach to encourage landowners to treat their land outside the City right-of-way. The WFPD will provide dumpsters for the debris.

Appendix B Recommended Projects

Palo Alto, California
Santa Clara County



DATA SOURCES: CWPP database; ESRI Topographic Base Map. Map created on 08/24/2016 by digitalmappingsolutions.com.

APPENDIX C - Treatment Areas to be Abandoned or Revised

After 5 years of program implementation, a small number of treatment areas are recommended to be abandoned or revised. This recommendation is due to the recognition of redundancies in the program, changes in neighboring landownership, or refinements in boundaries to ease implementation. The treatments areas that should be abandoned or revised appear on Map 3.

All treatments to be abandoned or revised are located in Pearson-Arastradero Park

A.C6 revision (Part 1) - This area is mowed annually, and should be continued. This constitutes the revised location, treatment and periodicity (in combination of the kmz AC6 revision Part 2).

A.C6 revision (Part 2) - This is a utility easement to be periodically maintained. It also serves as a strategic containment location. Treatment need not be done annually, but instead, in a 3-5 year interval. The method of treatment would be either mechanical equipment or hand labor. This, along with AC6 revision Part 1 (the area that is mowed annually) would replace AC6.

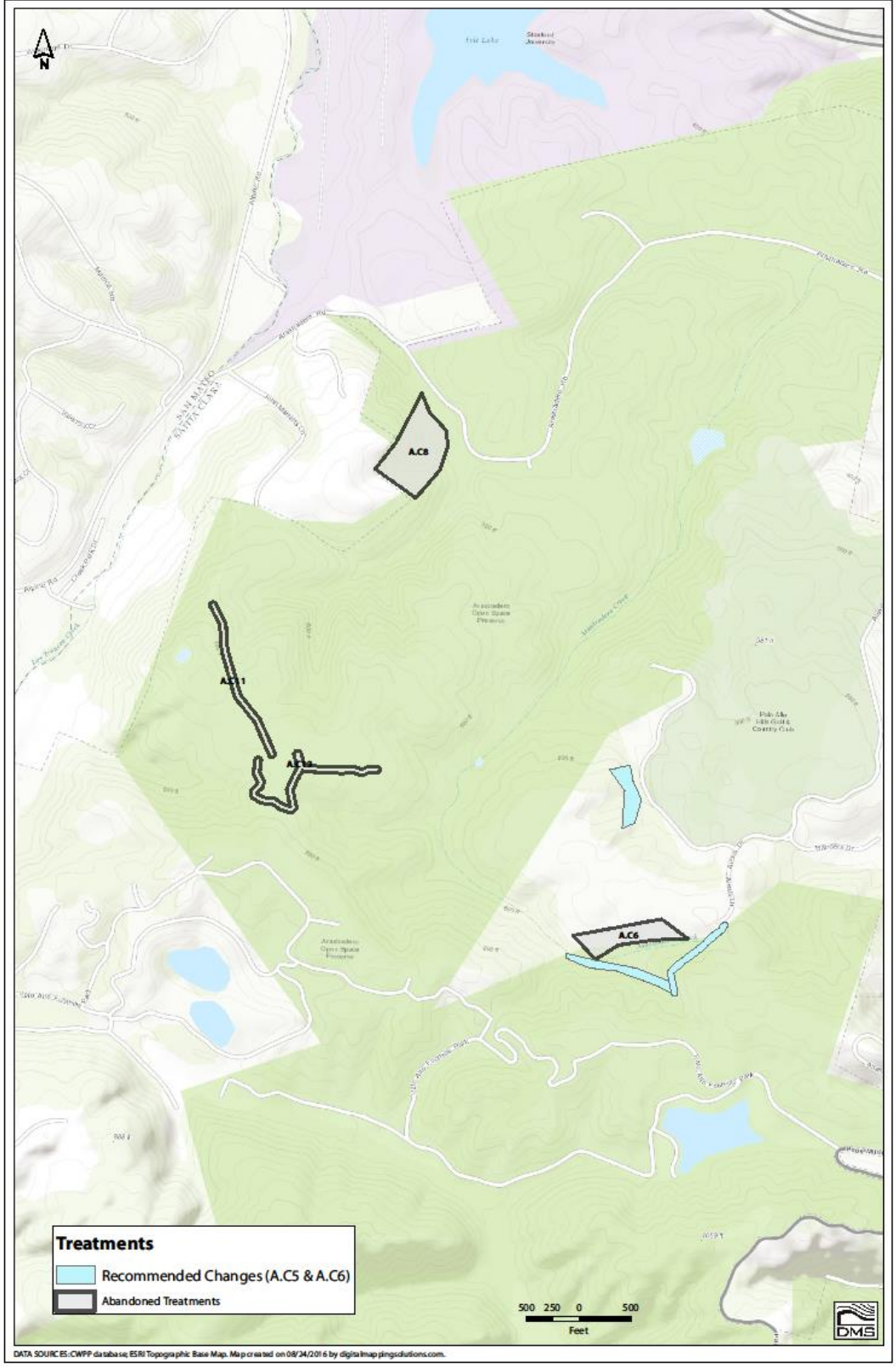
A.C8 revision-Mowing line#1 – A.C8 would not be treated with an area-wide treatment, but instead be treated with a few strips of mowing with mechanical equipment. A new kmz documents the first strip of mowing. The combination of all strips of mowing would substitute for A.C8.

Reduction of AC5 (refined notes) - This smaller area could be the new boundary for A.C5. Fuels are in a low hazard condition in the area that is proposed to be abandoned. The remaining treatment area could be treated with hand labor, with contract crews.

A.C11 and A.C13 - These areas need not be mowed or disked annually because adjacent trails and paths are maintained as firebreaks.

Appendix C Projects to be Abandoned

Palo Alto, California
Santa Clara County



DATA SOURCES: CWPP database; ESRI Topographic Base Map. Map created on 08/24/2016 by digitalmappingsolutions.com.

APPENDIX D – Program Costs

Treatments are accomplished by efforts from both City staff and contractors. The City contracts directly with one mechanical equipment service provider, and with the SCFSC. The list of areas treated by the mechanical equipment service provider and the SCFSC appears in Table 1.

City Contributions - Staff from the City Community Services Department annually disk and mow firebreaks, provide continuing outreach and education, and facilitate and coordinate equipment usage by contractors (including the SCFSC). The cost of these treatments and activities are born by the CS Department, and are not tracked as a cost to the FFMP/CWPP.

The treatment areas the City staff normally mow or disk are: A.C2, A.C3, A.C4, A.C7, A.C8, and A.C15.

Mechanical Equipment Service Contract – Every three years the City requests proposals and bids from contractors to treat F.C1-5, and F.F1-4, on Trappers Trail. In addition, this contractor maintains fire roads through annual grading of the roadbed surface. The current contract runs from 2015-2017 and amounts to over $70,000. Significant cost increases were experienced in the cost of the contract and can be expected to increase in 2017 by 20-30%.

Santa Clara County Firesafe Council (SCFSC) Contract – The City has provided the SCFSC with $50,000 for the FY 2013-2014, 2014-15 to perform work on City lands in order to promote implementation of the FFMP/CWPP. In FY 2015-16 $60,000 was added in order to fund additional scopes of work, under the agreed-upon work plan.

The SCFSC holds contracts with Project Coordinators who supervise CDCR crews (themselves under contract to the SCFSC) and private contractors, and who perform education and outreach regarding fire safety in the wildland urban interface.

Costs of the CDCR Crews are $300/day for a crew of 12-15 men and a van and CAL FIRE crew supervisor. The daily cost for the FSC Project Coordinator is approximately $240/day. Costs are not expected to increase significantly in the next 5 years, however crew availability is uncertain. The CDCR crews have treated evacuation routes both inside and outside the parks, created defensible space and ignition prevention spaces around barbecues within the parks, and treated many containment areas. The list of areas treated with the CDCR crews appears in Table 1.

The highest treatment costs are experienced when private contractors perform the work. Private contractors provide bids to perform services on areas where the use of the CDCR crews is not the best match. These include locations where traffic control is required, where there is possible contact with the public or where other safety concerns are present. Additionally, some locations require the type of services the CDCR crews cannot provide (i.e. mowing or grading). The costs for simply mowing grass along Arastradero Rd. (A.E1) was $8,800 in 2016, for example, whereas the cost for treating the same area was $7,540 in 2015, with $2,140 in private contractor cost (for traffic control) and approximately $5,400 for 10 days of work to but brush and trim trees. Costs of private contractors is expected to increase each year, based on increased labor and operating costs.

The SCFSC has and potentially will continue to augment funds from the City with grants or funds from partners. For example, $43,000 from PG&E is allocated in FY 2016-17 for work within 1000-ft of powerlines along upper Page Mill Road. Similarly, partnerships with MROSD are expected to result in the removal and/or treatment of eucalyptus groves in upper Page Mill Road on MROSD lands within the City. The South Skyline Firesafe Council treated portions of Skyline Road within the City. Similar partnerships can be expected to benefit the City in the next five years.

Table 1. Entity Responsible for Treatment

TREATMENT AREAS INSIDE PARKS			
Poly #	**Project Title**	**Location**	**Work to be performed by Whom?**
F.F1	*Firefighter Safety Zone 1*	*Trappers Ridge & Los Trancos Trail*	Mowing contractor
F.F2	*Firefighter Safety Zone 2*	*Trappers Ridge & Madron Fire Road*	Mowing contractor
F.F3	*Firefighter Safety Zone 3*	*Trappers Ridge high point*	Mowing contractor
F.F4	*Firefighter Safety Zone 4*	*Trapper Ridge south end*	Mowing contractor
		Foothill	
F.E2	*Evacuation Route - Park Road*	*Entrance to Maintenance Yard Las Trampas Valley*	SCFSC
F.E3	*Evacuation Route - Park North west*	*Interpretive Center to Hewlett property*	SCFSC
F.E4	*Evacuation Route - Park North east*	*Boranda Lake to Alexis Drive*	SCFSC
F.E5	*Secondary Evac Route*	*Towle Campground to Las Trampas Valley*	SCFSC
F.C1	*Containment*	*Trappers Trail*	Mowing contractor
F.C2	*Containment*	*Pony Tracks south of Trappers Ridge*	Mowing contractor
F.C3	*Containment*	*Pony Tracks north of Trappers Ridge*	Mowing contractor
F.C4	*Containment*	*Bobcat point*	Mowing contractor
F.C5	*Containment*	*North of entry Gate*	Mowing contractor
		Valley View Fire Trail	Mowing contractor
PA.3	*Los Trancos Road*	*Los Trancos Rd*	SCFSC
F.D.1	*Defensible Space*	*Entry Gate*	SCFSC

Poly #	Project Title	Location	Work to be performed by Whom?
F.D.2	*Defensible Space*	*Station 8*	SCFSC
F.D.3	*Defensible Space*	*Restrooms at Glen*	SCFSC
F.D.4	*Defensible Space*	*Interpretive Center*	SCFSC
F.D.5	*Defensible Space*	*Maintenance Complex*	SCFSC
F.D.6	*Defensible Space*	*Pumping Station at Campground*	SCFSC
F.D.7	*Defensible Space*	*Pony Tracks Water Tank*	SCFSC
F.D.8	*Defensible Space*	*Page Mill Road Water Tank*	SCFSC
F.D.9	*Defensible Space*	*Page Mill Road Water Tank*	SCFSC
F.I.1	*Ignition Prevention*	*Woodrat picnic area*	SCFSC
F.I.2	*Ignition Prevention*	*Roadside picnic area*	SCFSC
F.I.3	*Ignition Prevention*	*Orchard Glen north*	SCFSC
F.I.4	*Ignition Prevention*	*Orchard Glen south*	SCFSC
F.I.5	*Ignition Prevention*	*Group Campsite*	SCFSC
F.I.6	*Ignition Prevention*	*Campground*	SCFSC

Pearson Arastradero

A.C1	Containment	*Property boundary adjacent to Lidicott*	SCFSC
A.C4	Containment	*Property boundary adjacent to Paso del Robles*	SCFSC
A.C5	Containment	*Property boundary Laurel Glen - north*	SCFSC
A.C6	Containment	*Property boundary Laurel Glen - south*	SCFSC
A.C9	Containment	*Property boundary adjacent to John Marthens*	SCFSC
A.C10	Containment	*Arasterdero Creek (to Juan Bautista trail)*	Part of prescribed fire preparation

Poly #	Project Title	Location	Work to be performed by Whom?
A.C11	Containment	*Meadow Lark to Juan Bautista Trail*	Part of prescribed fire preparation
A.C14	Containment	*Arastradero to Rx fire area*	Part of prescribed fire preparation
A.C15	Containment	*Acorn Trail*	Part of prescribed fire preparation
A.D1	Defensible Space	*Interpretive Center*	SCFSC
A.D3	Defensible Space	*Pumping Station*	SCFSC
A.D4	Defensible Space	*Water Tank*	SCFSC
	Grading fire roads		Mowing contractor

Costs of New Treatment Areas – The new treatment areas are not expected to be a significant new cost because these costs should be borne by outside funding sources. The removal of eucalyptus groves on Upper Page Mill Road will be funded by either PG&E or MROSD. There will be minor amounts of administrative costs from the City. Similarly, the treatment of the eucalyptus on Stanford lands would be borne by Stanford or leases of the land, or potentially through grant funding. The recommended new treatment areas within Foothills Park is anticipated to be completed through the SCFSC, with CDCR crews. Based an estimated daily cost of $540/day, and an estimated need for 15 days of work to accomplish the scope, the work is expected to cost $8,100.

Time-stream of costs – The time stream of costs can be expected to rise incrementally, based on an increase in private contractor costs, and balanced by the increased area that need only be maintained (as compared with initial treatment or deferred maintenance). Funds can be augmented through collaboration with partners, a continued relationship with SCFSC, and grant funding.

Appendix E

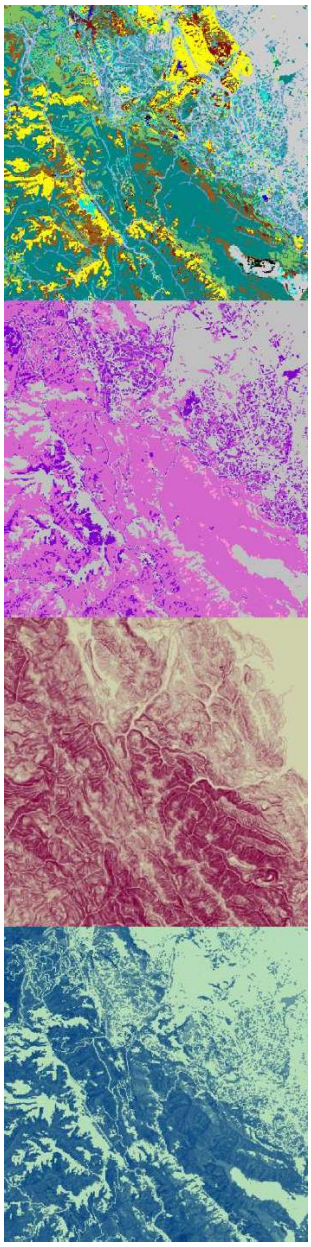
Technical Report:

FlamMap Fire Behavior Results for Palo Alto

Digital Mapping Solutions November 14, 2016

TABLE OF CONTENTS

SECTION 1 – DATA PREPARATION



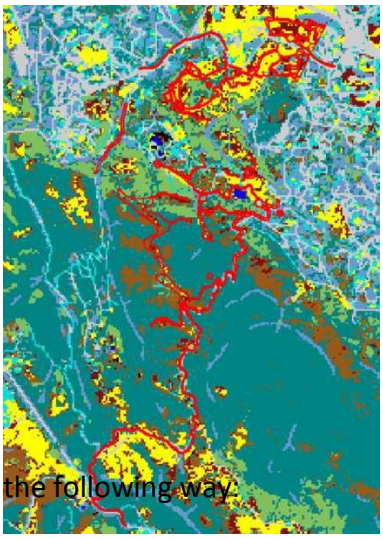
Eight data layers were downloaded using LANDFIRE's ArcMap using the LANDFIRE Data Access Tool. The following list details the version and attribute definitions for each layer:

1. Fuel Models – FBFM13 (LANDFIRE version 130). Thirteen typical surface fuel arrangements or "collections of fuel properties" (Anderson 1982) were described to serve as input for Rothermel's mathematical surface fire behavior and spread model (Rothermel 1972).
2. Canopy Cover – Described by percent cover of tree canopy in a stand.
3. Canopy Height – Described as the average height of the top of the canopy for a stand. Reported in meters * 10.
4. Canopy Base Height – Described by the lowest point in a stand where there is sufficient available fuel (0.25 in dia.) to propagate fire vertically through the canopy. Reported in meters * 10.
5. Canopy Base Density – Defined as the mass of available canopy fuel per unit canopy volume that would burn in a crown fire. Reported in kg/m^3*100.
6. Elevation – Described in meters.
7. Slope – Described in degrees (0 – 90).
8. Aspect – Described I degrees (0-259).

From these layers, a pre-fuel modification fire behavior landscape file was created and named Palo Alto_PRE.lcp. The extents of the LCP are as follows:

- North: 37.407735 degrees latitude
- South: 37.295132 degrees latitude
- West: -122.2478 degrees longitude
- East: -122.1164 degrees longitude

SECTION 1.1 – DATA MODIFICATIONS



Within the treatment areas, **fuel models** were changed in the following way:

- Grassy fuels (FM1 & FM3) were converted to a custom fuel model FM23 that represented mowed grass. Specific parameters for FM23 are included below.
- Shrub fuels (FM4, FM5, FM6) were also converted to FM23.
- Hardwood fuels (FM9 & FM10) were converted to FM8.

Within the treatment areas, the **canopy base height** changed in the following way:

- If canopy base height was lower than 8 feet (2.4384 meters or 24 meters*10), then canopy base height was changed to 24 meters*10.
- If canopy base height was higher than 8 feet (2.4384 meters or 24 meters*10), then no changes were made.

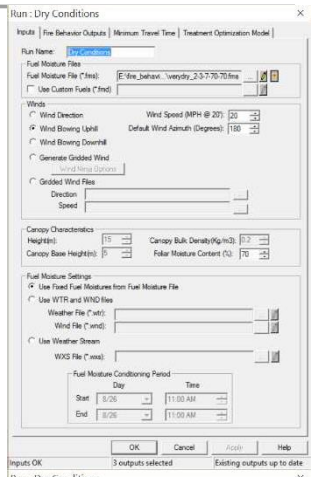
The changes were completed in ArcMap using standard GIS processing methods. The custom fuel model (FM23) was defined as follows:

Fuel Model Number	23
Fuel Model Code	FM23
1hr Fuel Loading (tons/acre)	0.300
10hr Fuel Loading (tons/acre)	0.000
100hr Fuel Loading (tons/acre)	0.000
Live Herbaceous Fuel Loading (tons/acre)	0.000
Live Woody Fuel Loading (tons/acre)	0.000
Fuel Model Type	Static

1hr Surface to Volume Ratio	3500
Live Herbaceous Surface to Volume Ratio	500
Live Woody Surface to Volume Ratio	500
Depth (feet)	0.500
Moisture of Extinction (percent)	11
Dead Heat Content (BTU/lb)	8000
Live Heat Content (BTU/lb)	8000
Fuel Model Name	Mowed Treatments

This fuel model definition is provided in a text file name 'FM23.fmd'.

SECTION 2 – FIRE BEHAVIOR PARAMETERS



Using FlamMap to predict fire behavior across the entire landscape, we chose to model fire under extreme dry weather conditions.

For all fuel models, we set our fuel moistures (in percent) to the following:

1hr fuels	3
10hr fuels	4
100hr fuels	5
Live herbaceous	70
Live woody	70

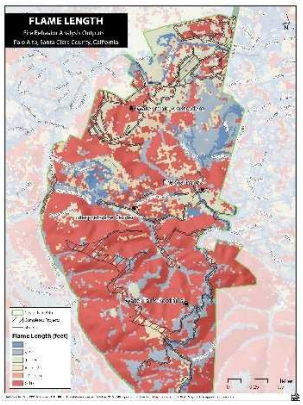
Filename: 3-4-5-70-70.fms.

Wind was set to 'Wind Blowing Uphill' at a speed of 20mph. Foliar Moisture Content was set to 70% and no conditioning weather or wind files were used.

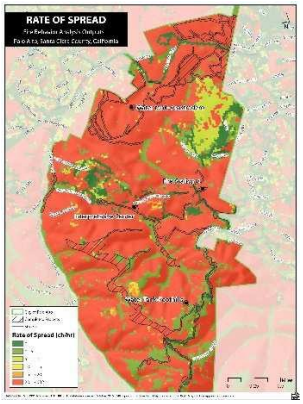
Outputs included Rate of Spread, Flame Length, and Crown Fire Activity using the Scott/Reinhardt (2001) option under the Crown Fire Calculation Method. We used the default for the 'Options' parameter (Relative Spread Direction From Maximum).

Both the pre- and post-fuel modification runs used the parameters above. The only exception is that for the post-fuel modification fire model run, we used the Custom Fuels file FM23.fmd (as described in the previous section).

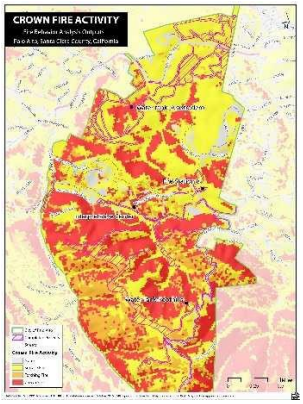
SECTION 3: PRE CONDITIONS RESULTS



Flame Length Results – Pre Fuel Modifications



Rate of Spread – Pre-Fuel Modifications



Crown Fire Potential – Pre-Fuel Modifications

Only three outputs were generated, however, more can easily be added. However, we focused on Flame Length, Rate of Spread and Crown Fire Potential as these are easily understandable.

Flame Length

Under these conditions, the landscape surrounding the fuel modification sites burn at what would be described as “extreme” fire behavior. Flame lengths reach far into the canopy. Mean flame lengths across the entire landscape are 40 feet, with a maximum of 213 feet. There is very little in the landscape that does not burn.

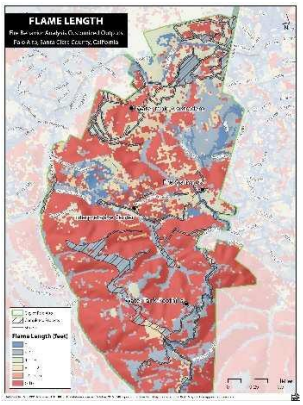
Rate of Spread

Rate of spread shows a similar trend with mean spread rates of 89 chains/hr (or 5,874 ft/hr) with a maximum of 634 chains/hr (or approximately 8 miles/hr).

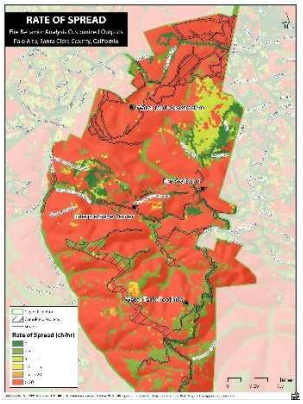
Crown Fire Potential

Given such conditions, torching and crowning is inevitable, as shown in the results. Active torching and crowning is expected where ever trees are.

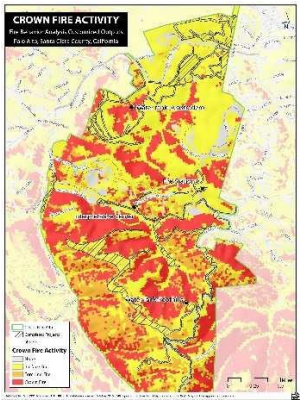
SECTION 4: POST CONDITIONS RESULTS



Flame Length Results – Post Fuel Modifications



Rate of Spread – Post-Fuel Modifications



Crown Fire Potential – Post Fuel Modifications

Again, three outputs were generated. Some details provided below.

Flame Length

Under these fuel moisture conditions, even after applying the fuel modification measures, the landscape surrounding the fuel modification sites still burned at what would be described as "extreme" fire behavior. Flame lengths reach far into the canopy. Mean flame lengths across the entire landscape are 40 feet, with a maximum of 213 feet. There is very little in the landscape that does not burn.

In the immediate area of the larger fuel modification sites, flames lengths were reduced from 9 feet to 2 feet.

Rate of Spread

The mean for rate of spread was reduced from 89 chains/hour to 88 chains/hour with a maximum of 634 chains/hr (or approximately 8 miles/hr).

In the immediate area of the larger fuel modification sites, rate of spread was reduced from 301 chains/hr to 47 chains/hr.

Crown Fire Potential

Crown fire potential remained the same since most of the fuel treatments that targeted canopy base height were done in very narrow fuel treatments.

SECTION 5: NOTES/OBSERVATIONS

Over all, the fuel modifications had local impact on modeled fire behavior. However, fire behavior remains unchanged on a larger scale. This indicates that targeted treatments affect strategic areas, providing localized safe areas for evacuation, firefighter safety during wildfires, and fire containment in an area of high fire hazard.

For most of the fuel modification projects, the treatments were confined to very narrow corridors, and were possibly under-represented in the results. This was due to:

1. The underlying data, which has a resolution of 30 meters or 98 feet. Some fuel modifications locations were lost when translated from a vector based file to a raster.
2. Even when the fuel modification ported over to the raster, it affected too few pixels to have a noticeable impact on fire behavior.

Larger fuel breaks would be captured in the model more easily and have great impact on fire behavior. Additionally, higher resolution data would more accurately portray the benefits of fuel management.