27 May 2009
Mr. Alessandro Amaglio
Environmental Officer
FEMA Region IX
1111 Broadway Street, Suite 1200
Oakland, California 94607

Re: Strawberry Canyon Vegetation Mitigation, Regents of the University of California, PDMC-PJ-09-CA-2005-011, Task Order HSFEHQ-06-J-0048, Contract HSFEHQ-06-D-0162

Dear Mr. Amaglio:

At your request, we have reviewed the responses provided by the University of California at Berkeley (UC) in a letter from Mr. Stephen Stoll and dated 25 March 2009 and addressed to Mr. Ken Worman ofthe California Emergency Management Agency (CalEMA). The UC provided these responses to a request from Ms. Sally Ziolkowski ofthe Federal Emergency Management Agency (FEMA) to CalEMA dated 17 February 2009. This letter contains our comments regarding the sufficiency and accuracy of the UC's responses to assist FEMA determine appropriate steps in the Environmental and Historic Preservation review process. Issue numbers correspond to the numbers used in the FEMA and UC letters referenced above.

Issue 1. Evidence that the supposed habitat restoration benefit will occur, since no plan for revegetation is included in the grant.

The UC responds accurately that, post-treatment, the project area will provide better growing conditions for plants in the understory because the plants will have increased access to resources (e.g., sunlight and soil nutrients) that will allow them to grow faster. In the absence of eucalyptus trees, which drop large quantities of leaf and branch litter containing toxic oils, it is likely that a new community of plants would rapidly colonize the site. However, we question the assumption that the types of vegetation recolonizing the area would be native. Based on conditions observed during site visits in April 2009, current understory species such as English ivy, acacia, *vinca* sp., French broom, and Himalayan blackberry would likely be the first to recover and recolonize newly disturbed areas once the eucalyptus removal is complete. These understory species are aggressive exotics, and in the absence of proactive removal there is no evidence to suggest that they would cease to thrive in the area, especially the French broom which would be the only understory plant capable of surviving inundation by a 2-foot-deep layer of eucalyptus chips.

In its letter, the DC provides photographs of pre- and post-treatment conditions from similar fuel removal projects in the East Bay Hills to document its assertion that native vegetation would naturally re-establish in treated areas. However, the photographs do not show young

native vegetation in the treated areas; instead they document (1) areas on the edge of treatment sites that are vegetated in native coyote brush both before and after treatment, (2) areas where mature coyote brush have survived a treatment, and (3) pre- and post-treatment conditions of a project that appears to be successful but lack dates or a description of how much time elapsed between the photographs. The photographs do provide evidence to support coyote brush survival at the edges of treatment sites. Coyote brush would be expected to survive treatment and inundation in chipped eucalyptus due to its shrubby, robust, woody form. However, the proposed treatment area does not contain an understory of coyote brush, nor would it be expected to as the species thrives on open dry sites, not under a closed eucalyptus canopy. The species is found in small openings of eucalyptus canopy within the proposed treatment area but these openings represent a small proportion of the entire treatment area.

As written, the current plan assumes native vegetation will reclaim the treatment areas but does not include any plans for native revegetation. Instead, in order to "reduce undesirable weed invasions" and thus encourage the development of native grasslands, chaparral, and bay/redwood communities, UC plans to apply chip mulch to the ground. This mulch would be derived from the cut, non-native eucalyptus trees. It is not clear how the mulch would prevent the proliferation of invasive species while simultaneously encouraging the growth of existing native species. Despite thorough research, we were unable to find documentation of the ability of exotic chip mulch to suppress undesirable species while encouraging favorable species. Chip mulch can be a successful deterrent to invasive plants, but would have to be coupled with selective native plantings if the intended long-term outcome was revegetation in native cover. In the absence of native plantings/seeding, it is likely that as the chips decompose (refer to Issue 6, below, for a discussion of decomposition rates) dormant seeds in the seed bed from the exotics that dominated the site pre-treatment will germinate and regain dominance. As written, the proposed project would likely delay but not prevent the reestablishment of non-native vegetation communities. Native cover could develop in small areas around existing, patchy, coyote bushes, but it is highly unlikely that the site would naturally restore itself to native conditions given the aggressive nature of the weedy exotic species that are already established in the treatment areas and dominate the seed bed. Additionally, in the 3 to 5 years that the UC claims the chips will decompose, it is anticipated that the proportion of aggressive non-native vegetation surrounding the treatment areas will have increased compared to native vegetation, unless a proactive eradication effort is implemented. Thus, the likelihood that seeding from surrounding vegetation will be aggressive exotic species will also have increased, thereby decreasing the likelihood of native species colonizing the treatment area. In the absence of a revegetation plan in the treatment area targeting native species plantings during the chip decomposition period, the risk of nonnatives colonizing the site once the chips have decomposed would have increased. Although in its letter the UC claims that it is "a regional standard to not re-vegetate as part of fuel management projects" because native species in the understory are responsive to improved growing conditions, it is also not a regional standard to recover the treated area in 2 feet of chips derived from an exotic fuel source.

Issue 2. Relative fire risk of current vegetation versus chip dominated landscape: there is no scientific evidence to support the project as proposed.

The UC accurately claims that standing eucalyptus is a greater fire hazard, all things considered, than chipped eucalyptus. We concur that eucalyptus forests pose a high fire risk to surrounding communities due to high fuel loads in the canopy and on the ground. It is well documented that the unique arrangement of fuels, content of oils and other volatile chemicals in the foliage, size and shape of the fuels, location of fuels, and height of ember production all contribute to this risk and can be mitigated through removal and of eucalyptus trees. However, the comparative risk between eucalyptus in the form of a dense standing forest versus the form of a 2-foot-deep mulch layer on the ground is not well documented. Studies have shown that mulch layers actually can pose a fire risk depending upon the type of material, the depth of the mulch, and the climate at the mulch site. Studies at the Ohio State

University Agricultural Technical Institute demonstrated that sparks from cigarettes or matches can lead to a subsurface smoldering fire in a variety of mulch materials 4 inches deep (Steward 2002). The recommended depth for landscape mulch is less than 4 inches (Appleton and French 1995) to avoid stifling growth of remaining trees and to avoid spontaneous combustion that can occur when decomposition of organic materials creates enough energy in a pile to ignite a fire. Fire Engineering Magazine (2008) reported that spontaneous combustion resulting in a catastrophic fire occurred in 10- to 20-foot piles. Although eucalyptus chips were not tested in these studies, Fire Engineering Magazine recommends that, to reduce the potential for fire in mulch, one should recognize that mulches high in oils ignite more easily and that mulch fires start more readily in hot climates where rain is scarce (and fuel moisture is low). Eucalyptus material is high in oils, and the East Bay Hills are subject to long annual periods that are hot and dry. The UC cites a study by Duryea et a1. (1999) where a high moisture level in mulch is assumed to assist the observed rapid decomposition rate in mulches; however, this study occurred in inland Florida where the climate is hot and humid and the study looked at a mulch layer that was less than 4 inches deep. It is likely that moisture retention would be significantly less in a thicker layer of mulch within a more moderate and arid climate such as the East Bay Hills.

In its letter, the UC proposes leaving up to 2 feet of chipped eucalyptus spread across treatment areas as both a weed barrier and as a fire prevention measure. However, the UC's claim that "since a canopy is absent during the time when the landscape is covered in chips, the concern over embers being generated from this location is almost eliminated" is contradicted by the proposed treatment plan, which explicitly leaves native canopy cover in treatment areas (i.e., California bay and coast live oak trees). Although the fire risk of bay and coast live oak is lower than eucalyptus, the misleading statement about an absent canopy undermines the argument that the risk of embers is eliminated.

Issue 3. Potential for introduction of chaparral-dominated landscape and issues associated with fuel-driven fires versus climate-driven fires.

As claimed by the UC, the removal of eucalyptus trees in the treatment area would reduce the risk of catastrophic fires driven (but not necessarily initiated) by climate conditions, such as

during periods with Diablo winds. One relevant metric for determining the level of risk a particular vegetation type poses as a wildland fuel in a wind-driven fire event is "spotting distance" (the distance an ember will carry beyond its source). As status by the UC, eucalyptus can spot up to 9 miles, which far exceeds the cited distances for other vegetation communities with potential to occupy the project area. Although chaparral is a high-risk vegetation type in fire-prone landscapes, its spotting distance is only 100 to 200 feet, and fires in this vegetation type are assumed to be driven by fuels.

The behavior of fuel-driven fires, understood as fires whose behavior is determined primarily by the type of fuels found on the landscape, could vary greatly on the post-treatment landscape depending upon the vegetation communities that develop. In the absence of a revegetation plan for the site, all possible future vegetation types in the treatment area must be analyzed; these vegetation types include native and non-native grasslands, chaparral, nonnative shrub/scrub communities, and oak-bay forests. Fire conditions in each ofthese landscapes are unique, for instance grasslands fuels burn cooler and faster than eucalyptus material, yet they are easier to ignite and carry fire quickly across a landscape. Chaparral is one of the most hazardous wildland fuel types in California due to the woody, persistent nature of the plants. A chaparral-dominated landscape in the post-treatment project area would create a fire hazard profile with its own suite of risks and concerns for fire protection, including flame lengths that far exceed those of the other possible vegetation types (Carle 2008). Although spotting distance is not as great for the fuels that make up chaparral communities when compared to a eucalyptus forest, chaparral fires burn with great intensity and are difficult to fight based upon the spatial arrangement of fuels on the landscape. Coast live oak forests are one of the most fire-resistant, tree-dominated fuel types due to characteristic thick bark and small persistent leaves (Sugihara et al. eds. 2006). To address the relative risk of fuel-driven fires in the various landscapes that could develop posttreatment, UC provides an incomplete list of different vegetation-based "fuel model" scenarios in Appendix A, which was attached to the UC's letter.

The proposed project assumes that regardless of the type and kind of vegetation community that forms in the newly cleared areas, the eucalyptus chip layer will retain adequate moisture to remove it as a concern in the fuel profile. As explained in the response to Issue 2, it may be inaccurate to assume that the chip layer, given its depth, can be ignored as a potential fuel source. However, such a deep chip layer may have the potential to not only sustain a localized burn but to connect fuels in vegetation types located adjacent to the treatment areas.

Issue 4. Justification of two species (Monterey pine and acacia) targeted for removal are a risk.

The DC accurately asserts that Monterey pine and acacia are regionally exotic species and, due to their success in the East Bay Hills, could undermine the establishment of native vegetation types in the post-treatment landscape by competing with oak and bay for dominance in the forest canopy. The UC inaccurately characterizes the fire hazard risk posed by the two species however. Monterey pine and acacia trees in the treatment areas occupy primarily the middle layers of the forest canopy. In limited areas individual Monterey pine

trees approach the eucalyptus canopy in height but this is not the case throughout the project area. Both the Monterey pine and acacia trees more likely serve as ladder fuels: during a forest fire they provide fuel continuity between flammable material on the ground and the lower branches of the dominant tree canopy in the overstory. However, they only serve this function in the presence of a taller overstory species such as blue gum eucalyptus. When found in forests in the absence of eucalyptus, Monterey pine trees are considered to be a fire hazard due to the accumulation of needles and branches below individual trees, but this would not pose a threat if the accumulated material was covered by 2 feet of eucalyptus chips. In the treatment area Monterey pine is found primarily in small patches of fewer than 5 trees, a spatial distribution that constitutes a low fire risk on the landscape. Acacia in the treatment area is concentrated around structures. These trees tend to accumulate quantities of seed pods and branches, but they would only be considered a risk based on their proximity to existing structures, not because of their vegetative contribution (i.e., fuel load) alone. Monterey pine and acacia trees in the treatment area only pose a substantial fire danger when growing within an eucalyptus forest. In the absence ofthe eucalyptus overstory, they do not pose a substantial fire hazard.

Issue 5. Complete analysis of other practical alternatives-(a) regularly clearing ground litter, (b) thinning targeted species rather than removing all and regularly clearing the understory, and (c) **creating strategic fuelbreaks.**

The UC states that alternatives to the proposed project should be analyzed for feasibility, effectiveness, and compliance with the Endangered Species Act. Feasibility is then described by the UC to include erosion, worker safety, costs, and endangered species. According to

NEPA's implementing regulations, FEMA must "rigorously explore and objectively evaluate all reasonable alternatives" (40 CFR Parts 1500 et seq.). FEMA would not, however, be required to evaluate alternatives that would not satisfy the goals of the proposed project or alternatives that are "infeasible, ineffective, or inconsistent" with basic policy objective (Headwaters, Inc. v. Bureau of Land Management, 914 F.2d 1174,20 EnvtL L. Rep. 21,378). Thus, feasibility (including cost) and effectiveness to meet the purpose and need can be valid reasons to screen alternatives from further consideration. However, potential environmental impacts such as increased erosion and take of endangered species should not be used to omit alternatives from further analysis. Therefore, the UC's justifications for eliminating alternatives because they are environmentally more harmful than the proposed project are not discussed in further detaiL Follovving is an analysis ofUC's claims that the alternatives suggested would be infeasible or would not meet the purpose and need of the project.

(aJ Regularly clearing ground litter. The UC makes a valid argument that this alternative would not meet the purpose and need. Removing ground litter would not address eucalyptus' primary fire-hazard characteristics (e.g., fuel density in canopies, spotting distance, aerial fuel loads) and the presence of shrubby surface fuels that could carry fires independent of cleared ground litter. Thus, the fire risk would essentially be the same pre- and post-treatment. Cost associated with annual work crews and disposal of material could also be prohibitive compared to the proposed project. Elimination of this alternative from further consideration is acceptable.

(b) Thinning targeted species rather than removing all and regularly clearing the understory. The UC accurately cites increased costs and a longer time period to implement as reasons that this alternative is not preferred, but the UC does not provide information that demonstrates that the increased costs or longer implementation period make this alternative infeasible. This alternative would not be as effective as the proposed project at reducing the fire hazard. However, this alternative would reduce the fire hazard and would thus meet the purpose and need. This alternative should be evaluated in future NEPA documents.

(c) Creating strategic fuelbreaks. The UC makes a valid argument that this alternative would not meet the purpose and need as the fire risk would essentially be the same pre- and posttreatment. Because of the height of the eucalyptus trees, the distance and topography between the project site and the ridgetop, and the fuel behavior in eucalyptus stands, a linear fuelbreak would not provide fire containment or fire control. Thus, the fire risk would essentially be the same pre- and post-treatment. Elimination of this alternative from further consideration is acceptable.

Issue 6. Document chips will decompose in 3 to 5 years.

The UC cites two published studies on eucalyptus chip decomposition to support its claim that the anticipated 2 feet of eucalyptus chips from the proposed project will decompose in 3 to 5 years. Many factors (e.g., soil type, climate, chip size, chip depth, species of eucalyptus) likely contribute to decomposition rates of eucalyptus chips. A study by Grove et al. (2008) confirms a strong correlation between eucalyptus mass and decomposition rates. The highest decomposition rate of eucalyptus was shown, in a controlled experiment, to be 78 percent in the first year and 68 percent in the second year (Faber and Spiers 2004). Chip size was not provided in this study, though the eucalyptus mulch was referred to being "shredded/chipped" with a significant portion of the mulch consisting of leaf matter. Further, the starting depth of the shredded/chipped eucalyptus in this experiment was just under 4 inches (i.e., 100 millimeters, not 100 centimeters as claimed in the UC summary of this study). Another study, based upon experimental conditions, demonstrated a 21-percent decomposition rate of eucalyptus mulch over 1 year (Duryea et a1. 1999). Similar to the Faber and Spiers (2004) study, the starting depth of the chip mulch in the Duryea et at. (1999) study was 3.5 inches. A thorough literature search did not identify any studies documenting decomposition rates in eucalyptus mulch deeper than 4 inches, which notably is the maximum recommended depth for landscaping (Steward 2002).

In lieu of more relevant data, we generated a simple model using an average of the decomposition rates of the two studies, modified for negative exponential decay, as shown by Faber and Spiers (2004), Goya et a1. (2008), and Grove et a1. (2008). This model predicts that 24 inches of eucalyptus mulch would take 10 years to decompose to a depth of less than 1 inch. For reasons described above, the model is rough and should only be used in comparison with the time for eucalyptus mulch to decompose to depths of less than 1 inch calculated by extrapolating the decomposition rates provided by the two eucalyptus mulch studies from starting depths ofless than 4 inches to the proposed 24 inches: 3 years (per Faber and Spiers

2004 data) and 14 years (per Duryea et al. 1999 data). Best scientific judgment suggests that a deeper chip layer would decompose more slowly than a shallow chip layer because it would be more insulated from moisture and less of its surface area would be in contact with decomposing bacteria and fungi found in the soil. Finally, the photographic documentation from similar treatment areas in the East Bay Hills, provided by UC to support its decomposition rate claim, does not appear to document a consistent viewpoint. In summary, the UC does not provide convincing evidence that the mulch at the depth proposed would decompose in 3 to 5 years.

The issue of chip decomposition also affects the evaluation of the UC's response to Issue 1 because the UC's argument for native revegetation is based upon its assumptions ofthe decay rate and behavior of the eucalyptus chips. By the time the chips fully decompose, the treatment area will likely be vegetated only sparsely with the shrubs and trees that remained post-treatment. After full decomposition, the exposed soil layer would be an ideal germination site for (1) seeds that have remained dormant in the seed bed and (2) seeds from plants in adjacent areas. Alexander and D' Antonio (2003) report that exotic invasive leguminous shrubs like French broom (which is present in and adjacent to the proposed treatment area) build up a larder seed bank in their introduced ranges compared with their native ones and in grassland systems they build a larger seed bed than native grasses. Seeds of successful, exotic species are opportunistic; given the abundance of established non-native species in the proposed treatment areas as well as adjacent to them, the post-decomposition exposed understory in the treatment areas could be quickly colonized by a non-native mix of Mediterranean grasses, Italian thistle, English ivy, various broom species, and *vinca* sp.

If you have any questions about these comments or this assignment, please contact either of us at 510.893.3600. URS appreciates the opportunity to support you on this task order.

Sincerely,

URS Corporation

Forest Ecologist

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Senior Project Manager

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