Appendix A-1

February 14, 2017

San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, CA 94102

Please Support the EIR Appeal
Significant Natural Resource Areas Management Plan

Dear Members of the Board of Supervisors,

We ask you to please support the appeal of the Environmental Impact Report (EIR) for the Significant Natural Resource Areas Management Plan.

We are concerned that the EIR violates CEQA law because it contains fundamental math errors, incorrect assumptions, and outdated science related to Greenhouse Gas Emissions.

We are concerned that the Significant Natural Resource Areas Management Plan violates AB 32, the California Global Warming Solutions Act, by generating significant carbon emissions and causing climate change by felling 18,448 large trees and only replanting 3,448 of them (a replacement rate of 0.19).

We are concerned that this Plan threatens public safety by causing climate change, degrading air quality, increasing mudslide risk, and spraying toxins in children's parks.

CEQA: The CEQA Guidelines §15364.5 require the City of San Francisco to determine the significance of impacts from Greenhouse Gas Emissions. Greenhouse gases include but are not limited to carbon dioxide, methane, and nitrous oxide. By law, the lead agency should make a good-faith effort, based on available information, to describe, calculate or estimate the amount of greenhouse gas emissions resulting from a project.

Please send the EIR back to Planning to correct the math errors and incorrect science contained within as follows:

- Math Errors: The EIR adds together a rate and a stock and produces a meaningless final number for Greenhouse Gas Emissions.

- 90% of Trees Deleted: The EIR assumes 90% of the existing trees are absorbing no carbon because they are over 20 years old. According to best available science from 2010 Forest Ecology & Management and the 2014 U.S. Geological Survey, older trees continue to actively sequester more carbon than younger trees. To be good faith, all 18,448 trees must be included in the Greenhouse Gas Emissions.

- Tree Survival Rates: The Greenhouse Gas calculations in the EIR presume that 100% of the newly-planted trees will survive. This is overly optimistic. SF Rec and Park's numerical model assumes that all new trees are live oaks. Per the Department of Public Works, oaks are known to be uneven survivors in San Francisco because they prefer heat, wind protection, and good drainage. This is why in the 1800s, oak trees were found in San Francisco only in limited numbers in creek beds. To be good faith, a more realistic tree survival rate needs to be incorporated into the EIR when estimating net Greenhouse Gas Emissions.

CEQA law requires the lead agency, SF Rec and Park, to answer the following questions in good faith. Would the project:

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

b) Conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases?

The EIR Responses to Comments (4-301) concludes, "There would be a calculated total net sequestration gain of 202 MT of CO2 per year." The Sharp Park portion of this total is shown as 64 MT, but this number is meaningless because it results from combining an annual rate with a stock. This is a fundamental math error that renders the result invalid.

When the math errors and assumptions are corrected using best available science and the same methodology, the new Greenhouse Gas calculations are shown below. Subsequently, a top sustainability and greenhouse gas verification firm was hired to perform the carbon calculations using best practices in accordance with AB 32. Per the attached appendix, they found that felling the 18,448 trees in the Plan would release total carbon emissions of **177,572 MT of CO2e** and would result in a loss of carbon sequestration over the life of the project of **-44,275 MT of CO2e**.

Greenhouse Gas Emissions for SNRAMP

	Annual Carbon Sequestration	**Carbon Emissions**
EIR with Errors:	Gain of +202 MT of CO2 per year	Not Presented
Corrected Math:	Loss of -2,401 MT of CO2 per year	65,101 MT of CO2
Top GHG Firm:	Loss of -44,275 MT of CO2e	177,572 MT of CO2e

Therefore, the Greenhouse Gas Emissions caused by the Natural Resource Areas Management Plan are significant under CEQA, violate the California Global Warming Solutions Act (AB 32), and must be mitigated.

The EIR Responses to Comments (4-301) erroneously concludes, “The proposed project would have a net GHG benefit and would not conflict with California’s goal of reducing GHG emissions set forth by the timetable established in AB 32.”

By presenting Greenhouse Gas calculations in the EIR that contain both fundamental math errors and assumptions that have been disproved by modern science, SF Rec and Park did not make a good-faith effort to estimate the greenhouse gas emissions from this project as required by law. Please refer the EIR back to Planning to remedy this.

Tree Replacement Rate: The tree replacement ratio in the EIR is only **0.19**. SF Rec and Park would replant only 3,448 trees out of 18,448 felled. Per the EIR on page 92, “Trees removed in San Francisco would be replaced with native tree species at a ratio of roughly one-to-one, although not necessarily at the same location or within the same Natural Area. For Sharp Park in Pacifica, many of the trees would be replaced not with trees but with native vegetation, specifically coastal scrub." The SF Rec and Park Memo "SNRAMP Tree Removal and Replacement" dated November 27, 2012 states, "At Sharp Park, a total of 15,000 trees will be removed and replaced over 20 years with native grassland or coastal scrub.” The numerical model used by SF Rec and Park to calculate Greenhouse Gases replants grassland in place of the 15,000 trees killed in Sharp Park.

This Plan will cause climate change by deforesting 15,000 large carbon-sequestering trees without replacement. We request that the minimum replacement rate be **1:1** or 18,448 trees. Best practice per the U.S. Forest Service 2016 would be **3:1** to account for the loss of carbon sequestration and the inevitable partial mortality of the saplings. If the replacement rate is not raised from 0.19 to a guaranteed 1:1 or higher with trees, then this Plan will cause climate change and threaten public safety.

Air Pollution: We are concerned that cutting down 15,000 trees without adequate replacement per the Significant Natural Resource Areas Management Plan will hurt human and environmental health by worsening air pollution. The EIR states that the deforestation “would result in significant unavoidable air quality impacts as a result of exceeding the BAAQMD thresholds for NOx pollutant emissions.” It concludes that “cumulative impacts associated with criteria air pollutants would be significant and unavoidable.” (EIR pages 438-440) We urge the SF Board of Supervisors to please send the EIR back to Planning for further air quality mitigation measures.

Herbicides: SF Rec and Park’s spraying of herbicides including Roundup required by the Plan is posing a threat to public health and safety. Per SF Rec and Park, “If you don't treat a felled eucalyptus stump with herbicides, it will come back." Glyphosate in Roundup was declared a probable carcinogen by the World Health Organization. The four toxic herbicides being used in the Natural Resource Areas are Roundup, Garlon 4 Ultra (triclopyr), Milestone (aminopyralid), and Habitat (imazapyr). San Francisco residents are very concerned that SF Rec and Park is polluting children’s parks with cancer-causing chemicals in order to kill trees that the public wants to stay standing.

In summary, SF Rec and Park's plan to cut down over 18,000 large trees without adequate replacement and spray toxic herbicides would damage public safety, public health, and the environment.

Please refer the EIR back to Planning so that it can provide an accurate picture of Greenhouse Gas Emissions under the California Environmental Quality Act and include further mitigation for the environmental harm to climate and public health. Otherwise, the City will be vulnerable to future risks under CEQA.

Please ensure that the City of San Francisco continues to be a global leader in the fight for climate resilience.

Thank you for your help and consideration.

Sincerely,

Nadine Weil

Nadine Weil
Founder
Heart of Green

cc: San Francisco Forest Alliance

Sources:

Increasing Wood Production Through Old Age in Tall Trees, Eucalyptus and Redwood, Stephen Sillett, Forest Ecology and Management Journal, February 2010: "Increasing wood production as trees age is a mechanism underlying the maintenance of biomass accumulation during forest development and the carbon-sink capacity of old-growth forests."
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Tree Growth Never Slows
Idea debunked that young trees have the edge on their older siblings in carbon accumulation, U.S. Geological Survey, Nature Journal, January 2014
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Carbon Capture: Tree Size Matters
Yale Environment Review, July 2015
http://environment.yale.edu/yer/article/carbon-capture-tree-size-matters#gsc.tab=0

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http://www.slideshare.net/arbordayfoundation/compensating-for-the-loss-of-a-healthy-tree-how-many-trees-do-you-owe-me

Mayor Ed Lee signs Mayors' National Climate Action Agenda Letter
November 2016
http://www.climate-mayors.org/our-letter-to-the-presidentelect-november-2016/

References:

Board of Supervisors File No. 170044

Final Environmental Impact Report for the proposed Significant Natural Resource Areas Management Plan per Planning Case No. 2005.0912E

NATURE JOURNAL

Tree growth never slows

Idea debunked that young trees have the edge on their older siblings in carbon accumulation.

Jeff Tollefson
January 15, 2014

Trees add an increasing amount of mass every year.

Many foresters have long assumed that trees gradually lose their vigor as they mature, but **a new analysis suggests that the larger a tree gets, the more kilos of carbon it puts on each year**.

“The trees that are adding the most mass are the biggest ones, and that holds pretty much everywhere on Earth that we looked,” says Nathan Stephenson, an ecologist at the US Geological Survey in Three Rivers, California, and the first author of the study, which appears today in *Nature*. “Trees have the equivalent of an adolescent growth spurt, but it just keeps going.”

The scientific literature is chock-full of studies that focus on forests' initial growth and their gradual move towards a plateau in the amount of carbon they store as they reach maturity. Researchers have also documented a reduction in growth at the level of individual leaves in older trees.

In their study, Stephenson and his colleagues analyzed reams of data on 673,046 trees from 403 species in monitored forest plots, in both tropical and temperate areas around the world. They found that the largest trees gained the most mass each year, capitalizing on their additional leaves and adding ever more girth high in the sky.

Although they relied mostly on existing data, the team calculated growth rates at the level of the individual trees, whereas earlier studies had typically looked at the overall carbon stored in a plot.

Estimating absolute growth for any tree remains problematic, in part because researchers typically take measurements at a person's height and have to extrapolate the growth rate higher up. **But the researchers' calculations consistently showed that larger trees added the most mass.** In one old-growth forest plot in the western United States, for instance, trees larger than 100 centimeters in diameter comprised just 6% of trees, but accounted for 33% of the growth.

The findings build on a detailed case study published in **2010**, which showed similar growth trends for two of the world's tallest trees — the coast redwood (*Sequoia sempervirens*) and the **eucalyptus** (*Eucalyptus regnans*), both of which can grow well past 100 meters in height. In that study, researchers climbed, and took detailed measurements of, branches and limbs throughout the canopy to calculate overall tree growth. Stephen Sillett, a botanist at Humboldt State University in Arcata, California, who led the 2010 study, says that the latest analysis confirms that his group's basic findings apply to almost all trees.

The results are consistent with the known reduction in growth at the leaf level as trees age. Although individual leaves may be less efficient, older trees have more of them. And in older forests, fewer large trees dominate growth trends until they are eventually brought down by a combination of fungi, fires, wind and gravity; the rate of carbon accumulation depends on how fast old forests turn over.

"It's the geometric reality of tree growth: bigger trees have more leaves, and they have more surface across which wood is deposited," Sillett says.

The findings help to resolve some of these contradictions, says Maurizio Mencuccini, a forest ecologist at the University of Edinburgh, UK. "On an absolute scale, the old trees keep growing far more."

The study has broad implications for forest management, whether in maximizing the yield of timber harvests or providing old-growth habitat and increasing carbon stocks. More broadly, the research could help scientists to develop better models of how forests function and their role in regulating the climate.

Appendix A-1
Technical Memorandum for Nadine Weil
02/16/17

Background:
This memorandum is intended to provide support to Nadine Weil regarding greenhouse gas (GHG) sequestration and emissions quantification related to implementation of the proposed Significant Natural Resources Area Management Plan (SNRAMP). The proposed activities include removal of non-native trees, predominantly *Eucalyptus globulus* (blue gum eucalyptus), in Pacifica (Sharp Park Natural Area) and in San Francisco (in several parks and natural areas), followed by subsequent replanting of the areas with diverse native vegetation types, as stated in the "Sequestration Study of Greenhouse Gases for SNRAMP" prepared by the firm Environmental Science Associates (ESA 2013).

The main purpose of this analysis is to provide a quantification using best practices of the carbon stored in the 18,448 trees proposed for removal at the Pacifica and San Francisco sites. Below and in the attached worksheet ("Euc_removal_GHG_021417.xls"), we provide detailed description of the quantification (including data and assumptions) used. Please note that much of the analysis uses the methods set forth in the US Forest Projects Protocol for California Air Resources Board's compliance offset forest protocols for AB32 Cap and Trade. These are the most rigorous methods available. In addition, we calculated the amount of annual mean sequestration that would occur over the 20 year proposed timeline of the study. For the purposes of the study, all trees proposed for removal were assumed to be *Eucalyptus globulus*.

In summary, our results indicate the following:

Carbon Storage and Annual Carbon Sequestration

Parameter Measured	**Sharp Park**	**San Francisco**	**Total**
Loss of stored carbon for all trees	-144,383 MT CO2	-33,189 MT CO2	**-177,572 MT CO2**
Loss of annual sequestration (over 20 years)	-36,000 MT CO2	-8,275 MT CO2	**-44,275 MT CO2**

The numbers reported here (shown in negative to indicate emissions if the trees are harvested) are much larger than those reported in the ESA 2013 study used in the EIR. While limited information is available regarding the calculations employed in the ESA study, a principle reason for the difference may be the key assumption made in the ESA 2013 study that carbon sequestration ceases at 20 years of age. Based on best current scientific information (e.g. Nature 2014 and prior), we do not believe it is appropriate to assume that sequestration ceases at 20 years of age, or at any age for healthy trees, for that matter. More information to this effect is provided on page 3 of this memo.

Methodology:
Greenhouse gas calculations were conducted by converting volume of trees to biomass to carbon content to metric tons of CO2e as follows.

Volume
Volumetric values were calculated in cubic feet from DBH values using local volume equations as follows:

Vol (cf) = a (DBH^b)
Where a and b are known species-specific regression coefficients.

The following local volume equation was derived from Pillsbury and Reimer (1997), from local coastal California eucalyptus globulus stands:

- Blue-gum eucalyptus: Vol (cf) = 0.055113 $(DBH^{2.436970})$
- = 0.055113 $(28.0''^{\,2.436970})$

Note: Vol = volume outside bark

Converting Volume to Biomass:

Once volume was derived, the following steps were taken to determine the amount of carbon stored in the standing live Eucalytpus trees. The methodology used was the Air Resource Board (ARB) Cap and Trade AB32 US Forest Project Protocol for determining the amount of carbon in the live standing trees (ARB 2014; Appendix C, Section C.1):

- Multiply the cubic foot volume by the appropriate wood density factor by species. This results in pounds of biomass with zero moisture content, also referred to as biomass of dry weight.

A wood density factor of 49.92 lbs/ft^3 was used, from the United States Forest Service's (USFS) Forest Inventory Analysis's wood density factor for *Eucalyptus globulus*.

- Biomass of dry weight= (volume * wood density)
- Multiply the biomass of dry weight values by 0.5 pounds of carbon/pound of wood to compute the total carbon weight.
- Divide the carbon weight by 2,204.6 pounds/metric ton to convert to metric tons of carbon.

Carbon estimates are presented in CO2 equivalent rather than carbon (C) alone. Once carbon weight was derived, the total metric tons of CO2 or CO2e were calculated by multiplying carbon by 3.67, the molecular weight ratio of CO2 to C (IPCC, 2007). Because the resulting carbon amounts were for trunks only, the following conservative ratio was used as a root to shoot ratio, added into the carbon total: 0.25.

Harvested Wood

The fate of the harvested wood determines the rate at which carbon is released into the atmosphere through decomposition. For example, if the wood is used in wood products, more carbon is retained than if it is allowed to decompose on the forest floor, or if it is mulched or sent to a landfill. Nowak et al 2002 modeled carbon content of wood over time following harvest, in two common tree disposal/utilization scenarios 1) mulching and 2) taking wood to landfills, two common tree disposal/utilization scenarios. Although no mulch decomposition studies could be found, studies on decomposition reveal that 37–56% of carbon in tree roots and 48–67% of carbon in twigs is released within the first 3 years. The remaining carbon was estimated to be lost within 20 years of mulching. For the purposes of this analysis, it was assumed that carbon in the harvested wood pool will be lost within 20 years; however a greater level of effort would be needed to determine this with greater accuracy.

Replacement with Native Vegetation following Removal of Trees:

The SNRAMP study states that removed trees at Sharp Park would be replaced with native grassland and coastal scrub over a 20 year period. ESA 2013 calculated replacement vegetation as grassland (rather than a scrub type) in the CalEEMod emissions estimator model. This is a conservative assumption given the scrub type would sequester more carbon than the grassland type. Replacement planting with trees in certain areas is also calculated in the ESA 2013 study.

A greater level of effort would be needed to prepare analysis for the replacement plantings. For the purposes of this report, the sequestration values for the replacement types are small compared to the numbers associated with the removal of trees.

False Assumption: Sequestration does not occur in trees 20 years and after

Based on best current scientific information (e.g. Nature 2014 and others), it is not appropriate to assume that sequestration ceases at 20 years of age. The study reported in Nature (2014) presents a global analysis of 403 tropical and temperate tree species, including *Eucalyptus* species, including 673,046 trees, demonstrating that for most species mass growth rate increases continuously with tree size. They found that the largest trees gained the most mass each year, capitalizing on their additional leaves and adding ever more girth high in the sky. The study finds that large, old trees do not act simply as senescent carbon reservoirs but actively fix large amounts of carbon compared to smaller trees. At the extreme, a single big tree can add the same amount of carbon to the forest within a year as is contained in an entire mid-sized tree. The apparent paradoxes of individual tree growth increasing with tree size despite declining leaf-level and stand-level productivity can be explained, respectively, by increases in a tree's total leaf area that outpace declines in productivity per unit of leaf area and, among other factors, age-related reductions in population density. The study's authors assert that their results resolve conflicting assumptions about the nature of tree growth, inform efforts to understand and model forest carbon dynamics, and have additional implications for theories of resource allocation and plant senescence.

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USFS. 2009. United States Forest Service Forest Inventory Analysis (FIA) regional species-specific equations for biomass.

cc: San Francisco Forest Alliance

Appendix A-1

Corrected Greenhouse Gas Emissions | Significant Natural Resource Areas Management Plan EIR

Carbon Storage in Standing Live Trees	**Sharp Park (Pacifica)**	**San Francisco**	**TOTAL**	**Data source**
# of trees to be felled	15,000	3,448		
# of acres	56			
Average tree density (trees per acre)	227.66	72.95		
Average DBH (inches)	28	28		HortScience data
Volume (Live tree Bole)				
Allometric equation for euc	**Blue-gum eucalyptus: Vol (cf) = 0.055113 ($DBH^{2.436970}$)**			Pillsbury Reimer 1997
regression coefficient a	0.06	0.06		
regression coefficient b	2.44	2.44		
DBH^b	3,362.64	3,362.64		
Volume (ft^3)/tree	185.33	185.33		
Biomass to Carbon (for Standing Carbon Storage)	**Dry Biomass of tree stem (in tons)= (volume * wood density)**			
Wood Density (lbs/ft^3) value for Eucalyptus globulus	49.92	49.92		FIA data (USFS 2009)
Dry Biomass (in lbs)	9,251.44	9,251.44		
Carbon fraction (lbs C/lbs of wood)	0.50	0.50		ARB 2014
C/tree (lbs)	4,625.72	4,625.72		
C/tree (metric tons)	2.10	2.10		
C, ALL trees (metric tons)	31,473.19	7,234.64		
CO2e, ALL trees(metric tons)	115,317.78	26,507.71		
Per Tree C02e (in metric Tons)	7.70	7.70		
Per Tree with roots (using root to shoot ratio 0.25) (in metric tons)	1.93	1.93		
Per Tree C02e including roots (in metric tons)	9.63	9.63		
Carbon Emissions				
CO2e (in metric Tons)	115,506.62	26,551.12		
With roots (using root to shoot ratio 0.25)	28,876.65	6,637.78		IPCC 2007
CO2e (in metric Tons) including roots	144,383.27	33,188.90	**-177,572.17**	Carbon Emissions
Loss of Annual Carbon Sequestration				
Mean Annual Increment for Eucalyptus (MT CO2/tree/year)	0.12	0.12		ESA 2013
Per Year Sequestration (all trees combined)(MT CO2/year)	1,800.00	413.76		
x 20 years	36,000.00	8,275.20	**-44,275.20**	

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Carbon Emissions using Diameter of Eucalyptus Trees

San Francisco Areas

Diameter

Diameter (in)	Average	Trees Sampled		Average Diameter
< 10	5	25	125	
10 - 19	15	208	3,120	
20 - 29	25	181	4,525	
30 - 39	35	140	4,900	
40 - 49	45	74	3,330	
50 - 59	55	28	1,540	
60 - 69	65	15	975	
70 - 79	75	2	150	
80 - 89	85	1	85	
90 +	90	1	90	
TOTAL		675	18,840	**28** inches

	Volumes	Carbon		MTCO2 total
0.037037	2.784	0.16973	555.55556	94
0.308148	40.491	1.9225	4622.2222	8,886
0.268148	140.602	6.3448	4022.2222	25,520
0.207407	319.228	14.0938	3111.1111	43,847
0.10963	588.817	25.6875	1644.4444	42,242
0.041481	960.429	41.5658	622.22222	25,863
0.022222	1443.011	62.1165	333.33333	20,706
0.002963	2045.136	87.6896	44.444444	3,897
0.001481	2774.534	118.606	22.222222	2,636
0.001481	3189.219	136.162	22.222222	3,026
TOTAL		49.43582	15,000	**176,717**
				Carbon Emissions

Source: HortScience Memo, January 2013

Age

McBride and Froehlich (1984) noted that almost all of the older blue gum stands in San Francisco were even-aged, established in a brief period in the late 1800s and early 1900s. Therefore, many trees are over 100 years old.

Conclusion:

We used the smaller of the two total MT CO2 #'s to be conservative, but thought it would be interesting to see this as well.