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April 27, 2021

CalEnviroScreen
c/o Sofia Mitchell
Office of Environmental Health Hazard Assessment
P.O. Box 4010
Sacramento, California 95812-4010

Dear Ms. Mitchell:

SUBJECT: COMMENTS ON THE DRAFT CALENVIROSCREEN 4.0

INTRODUCTION

This letter provides comments to the California Office of Environmental Health Hazard Assessment's (OEHHA) public draft version of version 4, California Communities Environmental Health Screening Tool (CalEnviroScreen 4.0). The letter also evaluates whether environmental justice issues and demographic conditions in the City of Los Angeles (the City) are adequately represented in the tool in order to urge the State of California to direct funding towards California's environmental justice communities based on need.

OEHHA developed CalEnviroScreen in 2010 to identify at a screening level those California communities that are most affected by and vulnerable to the cumulative impacts of pollution. The model was developed based on input from a statewide working group on environmental justice that pointed out the unmet need to assess cumulative pollution burdens and vulnerabilities affecting California communities. This framework was incorporated into the first (1.0) version of CalEnviroScreen, providing the first statewide assessment of cumulative impacts from pollution across California communities. Subsequent versions in 2014 and 2017 updated the assessment tool using the most current available data and incorporating various improvements and recommendations from residents, stakeholders, and government partners.

This letter comments on the most current draft release, Version 4.0. Version 4.0 uses the same methodology for scoring at the census tract level and provides relative versus absolute scores, but is updated with the most current demographic data and data for each of the pollution categories, including additional pollution/exposure indicators, such as lead-based paint in housing, additional pesticides, and the addition of chrome plating facilities, dairies, and feedlots.

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This comment letter considers both Policy Issues and Technical Issues. Policy Issues are more over-arching topics addressing the approach and application of the CalEnviroScreen program to the definition of an Environmental Justice Community, whereas Technical Issues are specific comments related to the inputs and use of the outputs in the CalEnviroScreen model.

Overall, we find that while CalEnviroScreen is a useful screening-level tool to identify pollution-burdened communities in California, it is less useful as a tool to address the broader issue of environmental justice. We present technical comments that identify items that should be corrected in the model, and additional factors that better characterize environmental justice for consideration of OEHHA to add. Our overarching recommendation is related to CalEnviroScreen being a screening-level model. By their nature, screening-level models provide an overview of an issue (such as pollution-burdened communities across the state) and allow for more detailed follow up studies to better characterize the issues with more specific data. We recommend that OEHHA encourage cities and counties to conduct more detailed local analyses, in addition to the statewide screening-level analysis, that brings municipality-specific knowledge to bear. This may be viewed as a local corrective lens to the statewide results, to expand the CalEnviroScreen output to include more specific data and additional factors beyond the 21 considered in the screening-level model. By encouraging and posting these city- and county-specific lenses, OEHHA would acknowledge that, in order to address the broader topic of environmental justice, greater specificity is available and necessary. To be clear, these corrective lenses would not change the CalEnviroScreen output, it would be a step beyond the output with the goal of making application of the model to environmental justice more focused on community need.

Our discussion of policy and technical issues are presented in the following sequence:

- Issue
- Technical Basis for Issue
- Recommended Resolution of the Issue

MAJOR POLICY ISSUES

Policy Issue 1: Environmental Justice is about more than pollution, therefore CalEnviroScreen is limited in its ability to define environmental justice communities.

Technical Basis for Issue: In 1994, President Bill Clinton signed Executive Order 12898, which required the Federal government to address environmental justice in its actions affecting minority and low-income populations. Since 1994, the National Environmental Policy Act (NEPA) has required Federal agencies to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations...." NEPA coverage of environmental justice issues has involved demographic data gathering to identify environmental justice communities based on either poverty or minority populations. The impact analysis addresses whether these communities have a disproportionate environmental impact, and encourages targeted outreach to help give community members a voice in decisions. Any disproportionate impact to an environmental justice community is potentially significant, not only those due to pollution.

California was slower to define its policies and requirements with respect to environmental justice, but legislation and guidance have been issued in recent years that aim to more comprehensively address environmental justice issues. These include Senate Bill (SB) 1000 (2016) and the Governor’s Office of Planning and Research’s (OPR) 2020 updated environmental justice element guidelines¹. In particular, SB 1000 has provided impetus for jurisdictions to address environmental justice in community planning.² Under California State law, environmental justice is “the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies” (Gov. Code, § 65040.12, subd. (e)). The principle of environmental justice ensures equal and equitable protection from environmental and health hazards, while giving people fair and equal access to the planning and decision-making process. Environmental justice considerations in California cover much more than pollution.

Issue Resolution: Because CalEnviroScreen has become the tool of choice for screening-level environmental justice analysis in California, the report should provide reference to OPR guidance identifying its limitations for this use, and identification of other more appropriate tools for this purpose.

Policy Issue 2: The CalEnviroScreen calculations weigh pollution and effects of pollution more heavily than population characteristics, which makes it less effective in conducting accurate environmental justice analysis or ranking for other purposes such as CEQA.

Technical Basis for Issue: CalEnviroScreen is a mapping tool developed by OEHHA in order to help identify census tracts in California that are disproportionately burdened by and vulnerable to multiple sources of pollution. The tool does not provide an overall analysis of environmental justice communities or environmental justice impacts within the State.

The California Global Warming Solutions Act of 2006 (AB 32) created the State’s cap-and-trade program, one of several strategies that California uses to reduce greenhouse gases (GHGs) that cause climate change. The State’s portion of the cap-and-trade auction proceeds are deposited in the Greenhouse Gas Reduction Fund (GGRF) and used to further the objectives of AB 32. In 2012, the Legislature passed SB 535, directing that 25 percent of the proceeds from the GGRF go to projects that provide a benefit to disadvantaged communities (DACs). In 2016, the Legislature passed AB 1550, which requires that 25 percent of proceeds from the GGRF be spent on projects located in DACs. To implement SB 535 and AB 1550, the DACs that need to receive the required investments from the state’s GGRF were to be identified using CalEnviroScreen, its primary, original purpose.

As described within the CalEnviroScreen 4.0 report [1], indicators are surrogates for the characteristic being modeled, so a high degree of uncertainty is inevitable. The model is

¹ Office of Planning and Research (OPR). 2020. General Plan Guidelines, Chapter 4: Required Elements. 4.8 Environmental Justice Element.

² The City of LA General Plan includes environmental justice in the Economic Development, Open Space and Conservation, Housing, Infrastructure and Public Services, Mobility Plan 2035, and 2015 Health and Wellness Element.

comprised of a suite of indicators that are considered useful in identifying places burdened by multiple sources of pollution with populations that may be especially vulnerable. Places that score highly for many of the indicators are likely to be identified as impacted. Because there are tradeoffs in combining different sources of information, the results are considered most useful for identifying communities that score highly using the model. Using a limited data set, an analysis of the sensitivity of the model to changes in weighting showed it is relatively robust in identifying the most impacted areas³. Use of broad groups of areas, such as those scoring in the highest 10 and 25 percent, is expected to be the most suitable application of the CalEnviroScreen results.

Use of CalEnviroScreen as a more precise tool, and using a precise threshold of 75% to define a DAC, is therefore beyond the model's initial focus and beyond its stated level of precision. It was never intended to be a tool for comprehensive environmental justice analysis or to support grant funding based on environmental justice needs.

CalEnviroScreen uses environmental, health, and socioeconomic information based on data sets available from state and Federal government sources to produce scores for every census tract in the State. Scores are generated using 21 statewide indicators in four categories: exposures, environmental effects, sensitive populations, and socioeconomic factors. Exposures and environmental effects characterize the pollution burden that a community faces, while sensitive populations and socioeconomic factors define population characteristics. That is, approximately half of CalEnviroScreen is measuring pollution sources, 25 percent measures health outcomes directly related to pollution, and 25 percent includes socioeconomic factors attributable to increased vulnerability to pollution. Consequently, the final scores for each census tract are more heavily weighted towards pollution exposure than population characteristics. An unintended effect of this calculation is that census tracts that are heavily polluted, but contain fewer people that meet the State definition of a "disadvantaged community" may receive a higher score than census tracts that have a larger disadvantaged community but a lower pollution score. This is especially apparent in the census tracts that fall in the upper middle ranking of all census tracts in the state (60th to 80th percentiles). For example, there are 35 census tracts in the state that do not receive a total score owing to "unreliable Population Characteristics". Fully 26 of these are in Los Angeles, and as described in detail in Technical Issue 1, the "unreliable characteristics" are due to environmental justice characteristics. Wilmington, in the City of Los Angeles, is unscored due to unreliable population characteristics, but should receive a score at a minimum of 85%. Another example is that there are 19 census tracts with high scores for community characteristics indicating potential environmental justice concerns, but the overall scores are less than 75% owing to lower pollution burden.

Use of CalEnviroScreen mapping and data for the purpose of CEQA analysis is recommended by OPR, but it has also been a point of debate. The current CalEnviroScreen 3.0 includes a brief disclaimer about its use for CEQA and land use planning: "To ensure proper use and

³ Meehan August L, Faust JB, Cushing L, Zeise L, Alexeeff GV. 2012. Methodological considerations in screening for cumulative environmental health impacts: Lessons learned from a pilot study in California. *International Journal of Environmental Research and Public Health* 9(9):3069-84.

understanding we explained that the tool is not a substitute for a cumulative impacts analysis under the CEQA. Nor is the intent to restrict the authority of government agencies in permit and land-use decisions.” Earlier versions included a longer disclaimer, which is often cited by those concerned about the tool because it references the differences in how CalEnviroScreen and CEQA define cumulative impacts.

Issue Resolution: Because CalEnviroScreen has become the tool of choice for environmental justice analysis in California, analysis and mapping should focus first on identifying census tracts that include disadvantaged communities based on population characteristics and then apply environmental factors. OEHHA should consider weighing population characteristics more heavily in their calculations and ranking, encouraging cities and counties to prepare “corrective local lenses” using more specific data, or provide reference to OPR guidance identifying its limitations for this use, and identification of other more appropriate tools for this purpose.

Policy Issue 3: OPR identifies several other screening-level tools that are more appropriate for identifying environmental justice communities, measuring burdens and impacts to those communities, and evaluating grant funding.

Technical Basis for Issue: CalEnviroScreen calculates a pollution score for each census tract based on 13 factors – 8 factors designated as Environmental Exposure factors (ozone, PM2.5, diesel particulate matter (DPM), drinking water, lead housing risk, pesticide, toxic release, and traffic), and 5 factors designated as Environmental Impacts (cleanup sites, groundwater threats, hazardous waste, impacted waterbodies, and solid waste facilities). In addition to pollution, there are numerous other factors that can be used to identify environmental justice communities and the potential impacts of future projects, pollution, and grant funding on them. These factors include, but are not limited to, the factors and data sources identified in Table 1 and provided in Attachment 1.

Table 1. Additional Environmental Justice Factors^{4,5}

Environmental Justice Factor	Data Metric(s)/Source(s)
Access to healthy food; food security	Supermarket, fast food, and convenience store locations/Healthy Stores for a Healthy Community; Map the Meal Gap; Healthy Places Index; Regional Opportunity Index
Access to parks, recreation, and open space	Park, open space, and trail locations/City data; Health Places Index
Access to reliable transportation	Public transit facilities, stops, and reliability; personal vehicle ownership or access/ Healthy Places Index, Regional Opportunity Index
Access to healthcare	Health insurance enrollment rates; hospital, medical and dental, and mental health provider locations; Regional Opportunity Index
Traffic safety	Vehicle crash rates; pedestrian and cyclist fatalities/City data
Violent crime rate	Homicide rate; gun violence rate/Climate Change & Health Vulnerability Indicators for California (CCHVI)
Climate change vulnerability	Heat, flooding, sea level rise, wildfire burden/CHAT Tool, CCHVI, Cal-Adapt, Urban Heat Island Index, tree canopy data
Ethnicity/Race	Percentage of population/ACS US Census Bureau
Obesity prevalence	Child and adult obesity rates/500 Cities-Local Data for Better Health, California Department of Public Health data
Proximity to heavy industry	Location of fossil fuel plants; manufacturing, auto body shops, etc./California Power Map
Percentage of children and elderly	Percentage of population/ACS US Census Bureau; CCHVI
Utility access	Households with electricity, natural gas and heating, broadband internet service
Vacant/underutilized lots	Prevalence of vacant or underutilized lots/Tax assessor records

Issue Resolution: OEHHA should allow cities and counties to prepare a “local corrective lens” to provide information on additional indicators that are relevant at the local level to identify environmental justice communities. The corrective lens would follow OPR guidance in recommending local jurisdictions to identify local factors that lead to environmental justice issues and indicators that define local environmental justice communities. We suggest certain indicators applicable to the City in our Technical Comments below. OEHHA should post these local analyses alongside CalEnviroScreen to improve public transparency related to environmental justice.

⁴ Office of Planning and Research. 2020. General Plan Guidelines. Chapter 4: Required Elements.

⁵ Office of Planning and Research. 2019. Defining Vulnerable Communities in the Context of Climate Change Adaptation. July.

MAJOR TECHNICAL ISSUES

Technical Issue 1: CalEnviroScreen misidentifies numerous census blocks as their own city rather than as communities within the City of Los Angeles, or simply mislabeled as the wrong city. It also fails to provide scores for some census tracts, and most of these unscored tracts are within the City of Los Angeles.

Technical Basis for Issue: CalEnviroScreen misidentifies numerous census blocks that are located within the City as independent cities rather than neighborhoods. As shown in the following figure, “Nearby Cities” as identified in the CalEnviroScreen model are actually within the City of Los Angeles limits.

In total, there are 32 areas mislabeled areas, shown in Figure 1 that are within the City of Los Angeles including those labeled as the following:

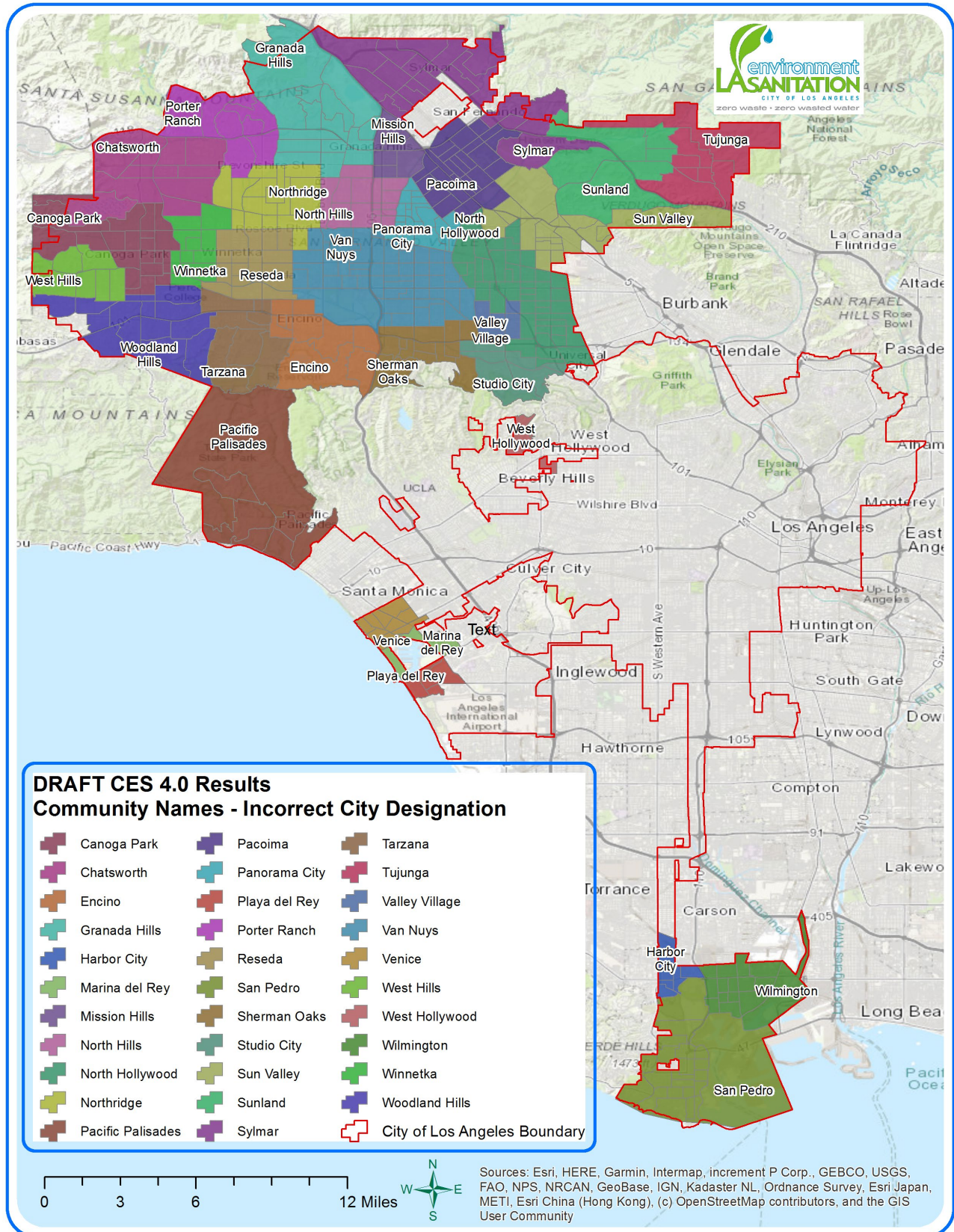
- Canoga Park
- Chatsworth
- Encino
- Granada Hills
- Harbor City
- Marina Del Rey
- Mission Hills
- Sunland
- Valley Village
- Venice
- Winnetka
- North Hills
- North Hollywood
- Northridge
- Pacific Palisades
- Pacoima
- Panorama City
- Playa Del Rey
- Tarzana
- Van Nuys
- West Hollywood
- Woodland Hills
- Porter Ranch
- Reseda
- San Pedro
- Sherman Oaks
- Studio City
- Sun Valley
- Sunland
- Tujunga
- West Hills
- Wilmington

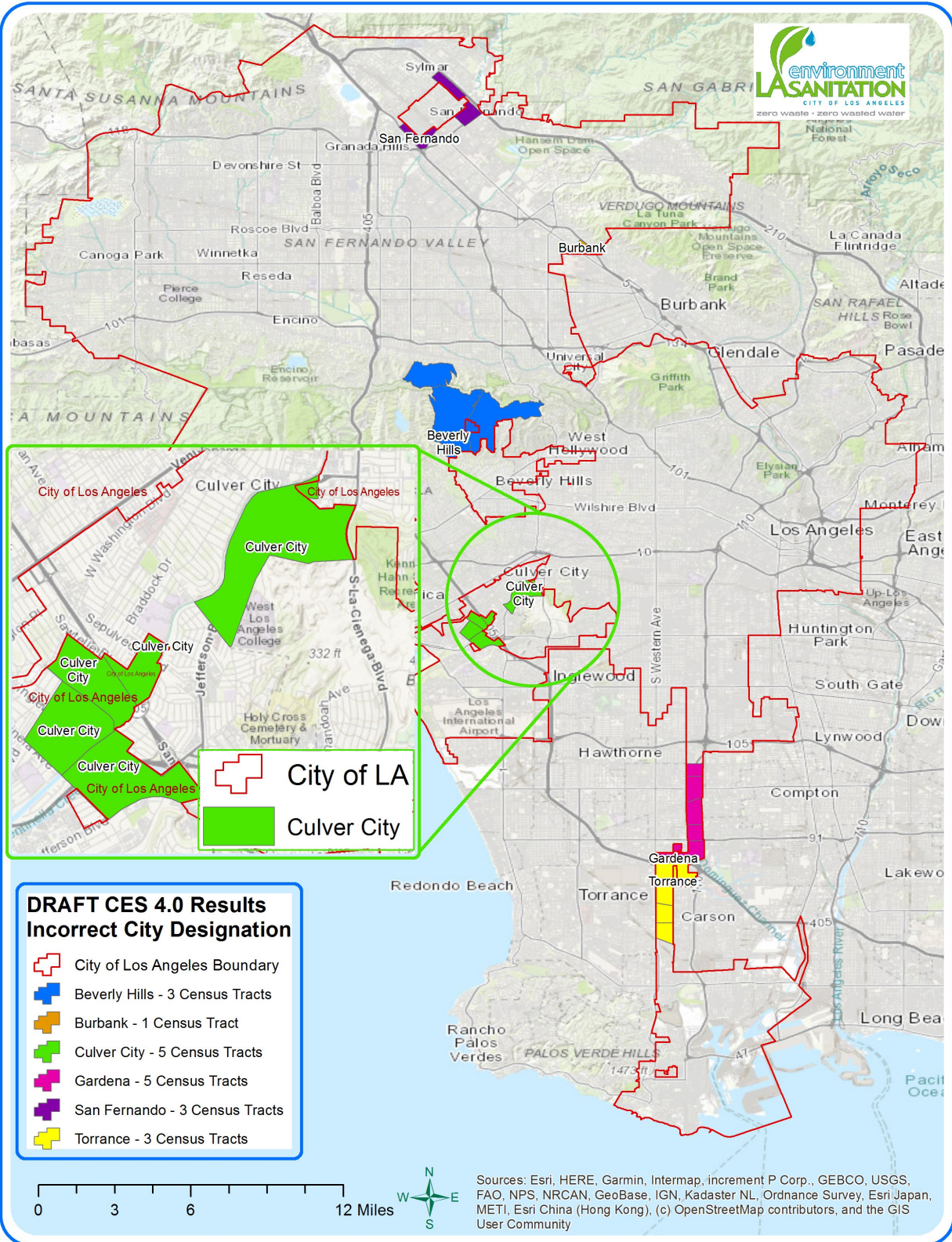
Further, various census tracts are incorrectly identified in the CalEnviroScreen database as being located within other neighboring cities (i.e., Beverly Hills, Burbank, Culver City, Gardena, San Fernando, and Torrance), when in fact these tracts are within the boundaries of the City of Los Angeles. The following figure illustrates those census tracts labeled as being within a separate city, but are in fact tracts within the City of Los Angeles boundaries (e.g., there are 5 census tracts labeled as part of Culver City in the CalEnviroScreen model, although these 5 census tracts are actually within the City of Los Angeles). Finally, there are 4 census tracts for which an individual tract has shared occupation by two separate cities (Beverly Hills/Los Angeles in tracts 6037261101 and 6037261102; Culver City/Los Angeles in tract 6037702502; Calabasas/Los Angeles in tract 6037800204).

The combination of these labeling errors results in the improper identification of 450 census tracts and over 1,750,000 City residents not allocated to the City. While the database indicates that City identification is used for the purposes of frame of reference rather than part of the

calculations, correct identification of census tracts to a city is extremely important in the application of the CalEnviroScreen tool when applying for grant funding or shared services.

With respect to **unscored census tracts**, according to the CalEnviroScreen report, there are 105 census tracts in California that are not assigned an overall CalEnviroScreen score due to unavailable or unreliable Population Characteristic indicator data scores. Of these, 35 census tracts throughout the State have Pollution Burden scores at or above the 75th percentile, but they are not assigned an overall CalEnviroScreen score. In spite of not having assigned overall CalEnviroScreen scores, these high pollution areas warrant consideration for designation as disadvantaged communities because they are burdened by significant environmental concerns. Moreover, these areas are frequently adjacent to communities that have high cumulative CalEnviroScreen scores. Of the 35 census tracts with a Pollution Burden above the 75th percentile that are not assigned an overall score, 26 are within the City of Los Angeles. Populated census tracts should be scored appropriately to identify the population characteristics and risks to these City residents.





As shown in the table below, the absent scores minimize risk for over 17,500 residents within the City of Los Angeles alone. A review of the dataset indicates that none of these census tracts were assigned population characteristic scores (all are N/A), even though many are clearly low-income with language barriers and/or high unemployment. Some of these census tracts are in areas known to experience disproportionate pollution burden and sensitivity. The community of Wilmington within the City of Los Angeles, for example, is not scored, but should clearly receive a score at a minimum of the 85th percentile. We understand that some are not scored because they include people that reside outside non-household group quarters, such as student housing or nursing homes, and several of the population characteristics rely on household level statistics. However, because CalEnviroScreen is used for the allocation of funds, by not scoring these census tracts, especially those with residents, these tracts have not been accurately identified as disadvantaged communities.

Census Tract	Total Population	California County	Zip	City of Los Angeles Neighborhood
6037980014	10	Los Angeles	90744	Wilmington
6037980010	189	Los Angeles	90012	Los Angeles
6037532400	52	Los Angeles	90058	Los Angeles
6037980031	1113	Los Angeles	90731	San Pedro
6037980009	5	Los Angeles	90027	Los Angeles
6037980028	0	Los Angeles	90045	Los Angeles
6037980022	0	Los Angeles	91344	Granada Hills
6037701100	1096	Los Angeles	90049	Los Angeles
6037980024	264	Los Angeles	91406	Van Nuys
6037980008	90	Los Angeles	91406	Van Nuys
6037115103	3393	Los Angeles	91330	Northridge
6037265301	11235	Los Angeles	90024	Los Angeles
6037980021	12	Los Angeles	91342	Sylmar
6037980019	151	Los Angeles	90272	Pacific Palisades
6037980020	0	Los Angeles	91352	Sun Valley
6037980023	0	Los Angeles	91311	Chatsworth
6037980026	37	Los Angeles	91042	Tujunga

Issue Resolution: The database should be corrected because of several population-based issues. The database should identify each census tract in accordance with its geographic location within Los Angeles City limits, not based on community name. The database must correct some misattributions of tracts within the City of Los Angeles that are now attributed to other

neighboring cities (Beverly Hills, Burbank, Culver City, Gardena, San Fernando, and Torrance). In tracts shared by two separate cities (Los Angeles shared with Beverly Hills, Culver City, or Calabasas) Los Angeles should be identified. Finally, at least 17,500 residents are within unscored census tracts; overall CalEnviroScreen scores are needed for all populated census tracts, particularly those areas that are known to be home to disadvantaged communities. As one example, the community of Wilmington within the City of Los Angeles, should be scored at a minimum in the 85th percentile.

Technical Issue 2: CalEnviroScreen is missing key factors that lead to accurate identification of an environmental justice community.

Technical Basis for Issue: The population characteristics included in CalEnviroScreen are too limited to account for environmental justice communities. Rather, the model identifies only pollution burdened communities. For example, percentage of minority populations is not included in the calculation. Rather the population characteristics are based on three factors for “sensitive populations” (prevalence of low birth-weight, cardiovascular disease, and asthma) and five socioeconomic factors (educational attainment, housing burden, linguistic isolation, poverty, and unemployment). To get the Population score, the sensitive population factors and the socioeconomic factors are averaged and then added together. While some of these population characteristics are more frequently observed in minority communities, in the City of Los Angeles, issues like housing burden, unemployment, and asthma are more generally distributed across the entire population as a result of the high cost of living in the City and large population and traffic. Therefore, these factors do not accurately represent the presence or absence of an environmental justice community. They are focused on sensitivity to pollution.

The draft report for CalEnviroScreen 4.0 states that the relationship between CalEnviroScreen scores of the state’s census tracts and their race/ethnicity compositions and children and elderly populations will be extensively examined as CalEnviroScreen 4.0 is finalized. The USEPA definition of environmental justice does not include mention of children or elderly populations. At the census tract level, the percentage of people ages 17 or under and 65 or older, is not very meaningful. These groups are better examined at a finer, more local level, such as identifying the specific locations of schools and nursing homes and evaluating those locations relative to specific point sources for pollution. However, incorporating race/ethnicity in the evaluation of whether a disadvantaged or environmental justice community is present would be useful. CalEnviroScreen already provides this data for informational purposes, but should incorporate the data into its calculations of population characteristics.

Issue Resolution: We highly recommend that OEHHA move forward with including further examination of factors beyond the 21 currently considered in calculating risk to environmental justice populations. OEHHA should incorporate data regarding race and ethnicity into its scoring for population characteristics in order to ensure that all census tracts that contain environmental justice communities are captured by the model.

Technical Issue 3: CalEnviroScreen does not incorporate issues of local concern that are reflective of environmental justice impacts, such as heat island effect, tree canopy density, and proximity to natural areas/open space.

Technical Basis for Issue: Structures such as buildings, roads, and other infrastructure absorb and re-emit the sun's heat more than natural landscapes such as forests and water bodies. Urban areas, where these structures are highly concentrated and greenery is limited, become "islands" of higher temperatures relative to outlying areas. Heat islands can contribute to a range of environmental, energy, economic, and human health impacts. Elevated temperatures can directly increase the concentration of ground-level ozone in these areas. Heat islands also contribute to higher daytime temperatures, reduced nighttime cooling, and higher air-pollution levels. These, in turn, contribute to heat-related deaths and heat-related illnesses, such as general discomfort, respiratory difficulties, heat cramps, heat exhaustion, and non-fatal heat stroke. Heat islands can also exacerbate the impact of naturally occurring heat waves, which are periods of abnormally hot, and often humid, weather. Sensitive populations, such as children, older adults, and those with existing health conditions, are particularly at risk during these events. These issues become especially relevant considering the effects of climate change (e.g., in 2020, the San Fernando area of Los Angeles reached weather-breaking temperatures of 121 degrees Fahrenheit and downtown Los Angeles reached 111 degrees Fahrenheit, hotter even than Death Valley during the same time period⁶). Therefore, analyses of tree canopy density and proximity to open space and natural areas are key components when considering the potential for heat islands to occur. Tree canopy is essential to maintaining health and wellbeing of City residents by protecting vulnerable populations from the sun, mitigating the urban heat island effect, and reducing public health risks, such as chronic respiratory illnesses. In many of the lower income, older, more densely populated areas of Los Angeles, trees and natural areas are nearly nonexistent.

The City of Los Angeles Department of Recreation and Parks completed a 2009 Citywide Community Needs Assessment and one of its key findings was that the City's over 420 parks and facilities are not equitably distributed, and many communities do not have equitable access to open spaces and parks. The accepted standard for adequate park space is 3 acres per 1,000 residents. The average for the City is 8.9 acres of park space per 1,000 residents in an area; however, communities such as Westlake and Southeast Los Angeles have access to less than 0.5 acre per 1,000 residents (Figure 1)⁷. The County of Los Angeles Tree Canopy Project has been ongoing since 2016 mapping trees in all unincorporated and incorporated areas of the County to provide accurate data at the parcel level regarding areas at most risk of heat island effect and most in need of expanded tree canopy cover.⁸

Issue Resolution: OEHHA should consider incorporating into its environmental factors, data from CalEPA's Urban Heat Island Index⁹, which quantifies the extent and severity of urban heat

⁶ NASA Jet Propulsion Laboratory. 2020. NASA's ECOSTRESS Monitors California's Record-Breaking Heat Wave. Available online at: <https://www.jpl.nasa.gov/news/nasas-ecostress-monitors-californias-record-breaking-heat-wave>. Accessed April 21, 2021.

⁷ Los Angeles Department of City Planning. 2015. Plan for a Healthy Los Angeles. A Health and Wellness Element of the General Plan. March.

⁸ Los Angeles County. 2021. Tree Canopy Map Viewer. Available online at: <https://lmu-la.maps.arcgis.com/apps/webappviewer/index.html?id=eed2401474d140f181f03e69a1d835e7>. Accessed April 20, 2021.

⁹ California Environmental Protection Agency (CalEPA). 2015. First of It's Kind Index Quantifies Urban Heat Islands. Available online at: <https://calepa.ca.gov/2015/09/16/urbanheat/>. Accessed April 20, 2021.

islands for each census tract in most urban areas throughout the state. The Index, created in response to AB 296 in 2012, assigns a score for each census tract in and around urban areas throughout the State of California. The scores are based on atmospheric models over two three-month long seasons and quantifies the extent and severity of heat island effects for cities in California. Also, as part of incorporating a more local lens onto the statewide datasets (see Policy Issue 3), the City has data available for tree canopy cover and park access¹⁰ that should be incorporated into the tool.

Technical Issue 4: CalEnviroScreen does not adequately consider proximity of sensitive land uses to freeways and freeway interchanges.

Technical Basis for Issue: As described by the California Air Resources Board (ARB) Environmental Justice Stakeholder Group and documented in ARB's 2005 *Air Quality and Land Use Handbook* and 2017 *Technical Advisory: Strategies to Reduce Air Pollution Exposure Near High Volume Roadways*, there are many instances of sensitive locations, such as schools and daycare facilities, located near major roadways, particularly in non-white and economically disadvantaged neighborhoods. Land uses where sensitive individuals are most likely to spend time include schools and schoolyards, parks and playgrounds, daycare centers, nursing homes, hospitals, and residential communities. The health effects of traffic pollution on children have been well documented. Researchers at the University of Southern California completed two major studies, in 2004¹¹ and 2007¹², that both showed reduced lung function in children aged 10 to 18 who attend school within 500 feet of roadways that have over 100,000 cars per day in urban areas. The metrics used for CalEnviroScreen 4.0 do not consider the relative greater exposure and impacts associated with traffic and associated emissions of DPM for these sensitive receptors. These types of impacts are greater in communities near transportation interchanges where traffic patterns are dramatically different from free-flowing traffic. Hot spots at intersections where traffic congestion is highest due to queuing of vehicles that are subject to reduced speeds are not accounted for in the CalEnviroScreen model.

Several census tracts adjacent to major arterial roadways and interchanges that also include a school within its boundaries are reported to experience a lesser impact associated with DPM than surrounding census tracts even though schools are also associated with greater traffic on local surface streets. As an example, census tract 6037205110 is adjacent to the major interchange for Highway 101, I-10, and I-5. This tract includes the Christopher Dena Elementary School and is reported to have a DPM percentile of 82, while all of the surrounding census tracts with similar

¹⁰ Trust for Public Land. 2020. Park Score. Available online at: <https://www.tpl.org/city/los-angeles-california>. Accessed April 22, 2021

¹¹ Gauderman J, Avol E, Gilliland F, Vora H, Thomas D, Berhane K, McConnell R, Kuenzli N, Lurmann F, Rappaport E, Margolis H, Bates D, Peters J. 2004. The Effect of Air Pollution on Lung Development from 10 to 18 Years of Age. *N England J Med*. 2004 Sep 9; 351(11):1057-67.

¹² Gauderman J, Vora H, McConnell R, Berhane K, Gilliland F, Thomas D, Lurmann F, Avol E, Kunzli N, Jerrett M, Peters J. 2007. Effect of Exposure to Traffic on Lung Development From 10 to 18 Years of Age: A Cohort Study. *Lancet*. 2007 Feb 17;369(9561):571-7

populations and proximity to major freeway segments are reported to have DPM percentiles ranging from 92 to 99. When comparing the asthma rate for census tract 6037205110 to adjoining census tracts, the rate of asthma for tract 6037205110 is greater than those closer to the freeway corridors, suggesting that this population may be at higher risk of health effects from exposure to DPM despite having a lower DPM percentile.

Further, there appears to be additional inequities in the source data for many census tracts along major arterials in the City and elsewhere. As an example, census tract 6037195802 is reported to have a population of 2,817, as well as the Hollywood Freeway (State Route 170) traversing the entire length of the tract with a reported traffic density of 3,691.43. The reported annual DPM in this tract is 0.492 tons per year, which is higher than 90% of the census tracts in California. However, the adjacent census tract 6037195903 has a reported population of 2,165 people with a much shorter segment of the Hollywood Freeway within its boundaries and a reported traffic density of 2,792.87. The reported annual DPM within this tract is 0.65 tons per year, which is higher than 95% of the census tracts in California. As neither tract includes any stationary sources identified by CARB, it is unclear why one tract with less impact from a major transportation corridor would be rated higher than an adjacent tract with greater population and greater traffic density. This type of error is identified in many census tracts along and adjacent to major transportation corridors.

Issue Resolution: OEHHA should consider incorporating into its environmental factors, sensitive receptors along major transportation corridors, as well as more local air quality data from monitoring stations closer to freeways and major interchanges. The emissions from delayed traffic at these types of facilities are much greater than currently accounted for in the CalEnviroScreen 4.0 metrics and use of available local data would better characterize the impacts to the surrounding communities and more accurately identify neighborhoods with disproportionate air quality impacts and associated health effects.

Technical Issue 5: CalEnviroScreen does not adequately consider emissions from seaports and airports.

Technical Basis for Issue: As identified by the USEPA, port-related diesel emissions impact public health and the climate.¹³ People who live in close proximity to ports can be exposed to air pollution associated with emissions from diesel engines at ports, including particulate matter, nitrogen oxides, ozone, and air toxics, which can contribute to significant health problems – including premature mortality, increased hospital admissions for heart and lung disease, increased cancer risk, and increased respiratory symptoms – especially for children, the elderly, outdoor workers, and other sensitive populations. Further, recent studies^{14,15} conclude that jet

¹³ U.S. Environmental Protection Agency (EPA). 2016b. National Port Strategy Assessment: Reducing Air Pollution and Greenhouse Gases at U.S. Ports. September 2016.

¹⁴ Habre R, Hui Z, Eckel S, Enebish T, Fruin S, Bastain T, Rappaport E, Gilliland F. 2018. Short-Term Effects of Airport-Associated Ultrafine Particle Exposure on Lung Function and Inflammation in Adults with Asthma. *Environ Int.* September 2019; 118: 48-59.

¹⁵ Bendtsen K, Bengtsen E, Saber A, Vogel U. 2021. A Review of Health Effects Associated with Exposure to Jet Engine Emissions in and Around Airports. *Environ Health.* 2021; 20: 10.

engine emissions have physiochemical properties similar to diesel exhaust particles and that exposure to jet engine emissions is associated with similar adverse health effects as exposure to diesel exhaust particles and other traffic emissions. Spatial pattern of air pollution impacts downwind of the Los Angeles International Airport (LAX) indicates that elevated concentrations of ultrafine particles (particles with aerodynamic diameter less than 100 nm) are observed up to 10 miles from the runways.¹⁶ However, the CalEnviroScreen 4.0 report notes that the data source of DPM “*does not account for meteorological dispersion of emissions at the neighborhood scale, which can have local-scale and year-to-year variability, or significant local-scale spatial gradients known to exist within a few hundred meters of a high-volume roadway or other large source of diesel PM.*” Therefore, CalEnviroScreen 4.0 underestimates the effects to Los Angeles communities downwind from airports.

In addition, a review of the DPM data tab on the CalEnviroScreen web tool states that “*Diesel emissions in California range between 0 – 15 tons per year.*” This statement is incorrect (i.e., the top five DPM sources in the South Coast Air Basin alone in 2017 accounted for 2,174 tons per year¹⁷). The CalEnviroScreen 4.0 tool also under-reports the annual DPM emissions from airport and port sources. Specifically, CalEnviroScreen 4.0 uses CARB estimates for DPM emissions on a 4x4 kilometer grid statewide. However, this method does not adequately account for the more heavily impacted communities surrounding ports and airports. As shown in the table below, the DPM emissions presented in CalEnviroScreen 4.0 are consistently significantly below the actual reported emissions for airport and ports in the Los Angeles region.

¹⁶ Hudda N, Gould T, Hartin K, Larson T, Fruin S. 2014. Emissions from an International Airport Increase Particle Number Concentrations 4-Fold at 10 km Downwind. *Environ. Sci. Technol.* 2014, 48, 12, 6628-6635. May 29, 2014.

¹⁷ South Coast Air Quality Management District. 2019. Criteria and Toxic Air Pollutants Emissions Inventory for Base and Future Milestone Years. July 2019. Available online: <https://www.aqmd.gov/docs/default-source/ab-617-ab-134/technical-advisory-group/presentation-july18-2019.pdf?sfvrsn=15>. Accessed April 20, 2021.

Census Tract	Area	DPM Emissions Reported in CalEnviroScreen 4.0 (tons/year)	DPM Emissions from Facility Emissions Inventory Data (tons/year)
6037980028	Los Angeles International Airport (LAX)	0.71	7.42 ^{*18}
6037980001	Hollywood Burbank Airport (BUR)	0.546	0.62 ^{*19}
6037980031	Port of Los Angeles	1.93	112 ²⁰
6037980033	Port of Long Beach	2.039	115 ²¹

** Emissions reported for Ground Support Equipment ONLY and is comprised of PM_{2.5} and PM₁₀ attributed to diesel engines.*

Similarly, CalEnviroScreen 4.0 underreports the concentration of ozone (O₃) for Los Angeles area ports as compared with data from monitoring stations in close proximity to these facilities. As shown in the table below, the O₃ concentrations presented in CalEnviroScreen 4.0 are consistently below the actual reported O₃ concentrations for ports in the Los Angeles region. Note also that the CalEnviroScreen web tool states that O₃ concentrations in California range between 0.02 and 0.07 ppm, which is not correct. For PM_{2.5}, CalEnviroScreen web tool states that PM_{2.5} concentrations in California range between 1.9 and 16.4 µg/m³, which is also not correct.

¹⁸ Los Angeles World Airports. 2019. Air Quality Improvement Measures – 2017, 2023, 2031 Emissions Inventories with AQIM Potential Emissions Reductions. September 2019. Available online: <http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/facility-based-mobile-source-measures/technical-support-document-lax.pdf?sfvrsn=13>. Accessed April 20, 2021.

¹⁹ Hollywood Burbank Airport. 2019. Air Quality Improvement Measures – 2017, 2023, 2031 Emissions Inventories with AQIM Potential Emissions Reductions. September 2019. Available online: <http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/facility-based-mobile-source-measures/technical-support-document-bur.pdf?sfvrsn=13>. Accessed April 20, 2021.

²⁰ Port of Los Angeles. 2020. Port of Los Angeles Inventory of Air Emissions – 2019. Available online: https://kentico.portoflosangeles.org/getmedia/4696ff1a-a441-4ee8-95ad-abe1d4cddf5e/2019_Air_Emissions_Inventory. Accessed April 20, 2020.

²¹ Port of Long Beach. 2020. Port of Long Beach Inventory of Air Emissions – 2019. Available online: <https://thehelm.polb.com/download//14/emissions-inventory/10596/2019-air-emissions-inventory.pdf>. Accessed April 20, 2021.

Census Tract	Area	O ₃ Emissions Concentrations Reported in CalEnviroScreen 4.0	O ₃ Emissions Concentrations from Facility Monitoring Data
		(µg/m ³)	(µg/m ³)
6037980031	Port of Los Angeles	0.04	0.057† ²²
6037980033	Port of Long Beach	0.04	0.066‡ ²³

* Emissions reported for Ground Support Equipment ONLY and is comprised of PM_{2.5} and PM₁₀ attributed to diesel engines.

† Maximum daily 8-hour O₃ concentrations as reported for year 2019 at San Pedro Community station.

‡ Maximum daily 8-hour O₃ concentrations as reported for year 2019 at Superblock station.

Lead emissions at airports are not considered at all in the CalEnviroScreen 4.0 metrics. Federal studies have found that leaded airplane fuel is a significant source of air pollution in neighborhoods surrounding LAX. There are similar issues of heavy exposure at smaller general aviation airports in the City, including Van Nuys Airport and Whiteman Airport in Pacoima. Leaded aviation gasoline is the single largest source of lead in the United States’ atmosphere and about 45% percent of ambient lead is emitted by small piston-engine aircrafts.²⁴ In California, general aviation accounts for about 91% of lead in the atmosphere.²⁵ Recent research has found that children living near general aviation airports have higher blood lead levels than children living farther away, and studies have linked high childhood lead levels to a host of serious health problems. The Center for Environmental Health has compiled maps for airports in the Los Angeles area, detailing the extent of the lead pollution and highlighted the potentially exposed neighborhoods.²⁶ These maps illustrate that communities in the areas surrounding airports are at greater risk for lead exposure and are often comprised of low-income and minority populations, which represents additional consideration in terms of environmental justice issues related to airport-related emissions.

Issue Resolution: OEHHA should consider incorporating into its environmental factors, air quality data from airport and port facilities. The emissions from these types of facilities are much

²² Port of Los Angeles. 2020. Air Quality Monitoring Programs at the Port of Los Angeles May 2019-April 2020. Available online: <https://monitoring.cleanairactionplan.org/wp-content/uploads/2020/10/POLA-15th-Annual-Monitoring-Report-May-2019-April-2020.pdf>. Accessed April 20,2020.

²³ Port of Long Beach. 2020. Air Quality Monitoring Programs at the Port of Long Beach Annual Summary Report Calendar Year 2019. Available online: <https://monitoring.cleanairactionplan.org/wp-content/uploads/2020/06/POLB-Summary-Annual-Report-for-2019-PDF.pdf>. Accessed April 20, 2021.

²⁴ U.S. Environmental Protection Agency. 2014. Lead Emissions from Use of Leaded Aviation Gasoline in the United States: Technical Support Document (EPA420-R-08-020).

²⁵ U.S. Environmental Protection Agency. 2017. 2017 National Emissions Inventory: California State Summary.

²⁶ Center for Environmental Health. Californians Affected by Lead from Aviation Fuel. Available online: <https://ceh.org/air-and-water/avgas-map-californians-affected-by-lead-from-aviation-fuel/>. Accessed April 21, 2021.

greater than currently accounted for in the CalEnviroScreen 4.0 metrics and use of available local data would better characterize the impacts to the surrounding communities and more accurately identify neighborhoods with disproportionate air quality impacts and associated health effects.

Technical Issue 6: CalEnviroScreen 4.0 added a lead-based paint issue, but it fails to capture the larger-scale impacts associated with lead exposure from other major sources.

Technical Basis for Issue: OEHHA has evaluated an indicator of the age of housing as a proxy for lead in homes; however, this is not a suitable indicator, as this information does not consider whether a home has been renovated or updated. As such, the methodology for evaluating lead exposure in the home is more indicative of how old a city is rather than the actual risk of exposure to lead and relative impacts on vulnerable communities.

As noted in the Draft CalEnviroScreen 4.0 Report, other indicators can account for some of the other sources of lead, such as drinking water contaminants, toxic releases, and cleanup sites indicators. However, lead is identified as a contaminant in the Drinking Water Contaminants indicator only if it is tested and reported by a public water system or if it is present in the groundwater areas that are not served by public water systems. Data on lead contamination as a result of lead pipes in the home is not available statewide and is not accounted for in the model. In addition, although the Toxic Release from Facilities indicator may incorporate the data from the Toxic Releases Inventory (TRI) for a reported release incident, it does not account for long-term releases and accumulation/persistence of lead in the surrounding community as was the circumstance for the communities within approximately two miles of the Exide Battery Facility located in Vernon.

Also, as noted for Technical Issue 5, communities surrounding airports also have greater lead exposure due to dispersion of emissions from aircraft using lead-based fuels. Leaded aviation gasoline remains the single largest source of lead in the United States' atmosphere, which has resulted in higher blood lead levels in children living nearby airports and airstrips.

Issue Resolution: Given that lead exposure in children is of particular concern for identifying impacted communities, OEHHA should either include an indicator of lead poisoning, or other information on blood-lead testing. Alternatively, other major sources of lead such as airports, lead smelter facilities, and waste incinerators should be brought forward and incorporated into the metrics for lead exposure to surrounding communities.

Technical Issue 7: CalEnviroScreen does not accurately reflect the cumulative impacts of certain pollution burden indicators to nearby communities.

Technical Basis for Issue: Certain pollution indicators have multiple environmental justice impacts. For example, active solid waste facilities impact local communities beyond the impacts of solid waste pollution and odor. These facilities are known to impact surrounding communities due to idling of large trucks, increased traffic, increased DPM and PM_{2.5}, and noise impacts. Larger facilities not only process more solid waste, but create more traffic, air pollution, and noise that impacts a greater geographic area than do small facilities. The use of a 1,000-meter

radius for each solid waste facility, regardless of size and intensity of operation, not only underestimates the potential impacts of large facilities, but also the impacts to communities in the greater vicinity of multiple facilities. For example, census tract 6037232600 is ranked in the 0 percentile for solid waste, 47th percentile for traffic, and 43rd percentile for DPM, yet it is immediately east of census tract 6037702502, which has at least four active solid waste facilities and is ranked in the 95th percentile for solid waste, 81st percentile for traffic, and 54th percentile for DPM. Based on these rankings, the cumulative impacts of the solid waste facilities located in 6037702502 to the communities located in 6037232600 are not appropriately accounted.

Similarly, the Exide lead smelter site within the City of Vernon is highly contaminated, the former owner is bankrupt, and the state is conducting site assessment and risk assessment. The area of impact has a radius greater than 1.7 miles from the site, including a portion of the City of Los Angeles. The data used by CalEnviroScreen fails to characterize the multimedia effects of this site to the community (including limitations on City-wide tree planting and vegetable gardening initiatives due to risks to landscapers from dust, and other effects) and the larger role in environmental justice than simply the pollution burden.

Issue Resolution: The radius of impacts from a solid waste facility should be relative to the size of the facility and relative intensity of operations, with a smaller radius for smaller facilities and a larger radius for larger facilities. OEHHA should encourage cities and counties to conduct more detailed and accurate assessment of these effects, including effects of large contamination sites beyond the scale addressed by CalEnviroScreen.

Technical Issue 8: CalEnviroScreen does not incorporate data on contaminants of emerging concern, including per- and polyfluoroalkyl substances (PFAS).

Technical Basis for Issue: The current Drinking Water Contaminant indicator is based on 13 contaminants, none of which are those of emerging concern. The USEPA issued a lifetime health advisory for perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), two types of PFAS, for drinking water in 2016²⁷, and OEHHA added PFOA and PFOS to the list of chemicals known to the state to cause reproductive toxicity (developmental endpoint) for purposes of Proposition 65 in 2017. Groundwater contamination by PFAS is associated with industrial facilities where PFAS were/are manufactured or used in other products, airfields that use the chemicals for firefighting, or in areas near landfills that accept items containing PFAS. As disadvantaged communities are more likely to be located near these land uses than the general population, PFAS represent a potential additional burden to these communities.

Issue Resolution: While Assembly Bill 756 authorized the State Water Board to monitor PFAS, these statewide data are not yet available. However, PFAS data are available from drinking water testing conducted in 2013-2015 from public water supplies serving more than 10,000 people, pursuant to the USEPA's Unregulated Contaminant Monitoring Rule, as well as additional data from water systems serving less than 10,000 people, which reported approximately 400 drinking

²⁷ U.S. Environmental Protection Agency (EPA). 2016a. Lifetime Health Advisories and Health Effects Support Documents for Perfluorooctanoic Acid and Perfluorooctane Sulfonate. 81 Federal Register 33250.

water results for PFOS and PFOA. Further, in March 2019, the Division of Drinking Water issued Health and Safety Code 116400 Orders to 600 water system sites, indicating possible PFAS contamination. Nearly 250 locations, such as airports with fire training and response areas and municipal solid waste landfills, are being reported to the State Water Boards and data was collected into early 2020.²⁸ All available PFAS data should be incorporated into the Drinking Water Contaminant indicator.

OTHER ISSUES

Table 1: Other Issues with CalEnviroScreen 4.0.

Category	Issue	Implication or Resolution
Traffic	There are 35 census tracts with reported traffic density of -999.	The negative traffic density results in a calculated traffic density percentile of 0, leading to under-represented traffic impacts for these tracts.

CONCLUSION

Please include LASAN in the updates to the CalEnviroScreen 4.0.

LASAN appreciates the opportunity to respond to this request for comment. Should you have any questions, please contact Dr. Mas Dojiri, Assistant General Manager at (213) 485-2210, or Melissa Plamondon, CleanUp Green Up Ombudsperson at (213) 485-3905.

SINCERELY,



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ECZ/MD:mp

- c: Rafael Prieto, Office of the Chief Legislative Analyst
- Max Podemski, Council District 6
- Traci Minamide, LASAN – EXEC
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- Hassan Rad, LASAN – RAD
- Melissa Plamondon - CUGU

²⁸ https://www.waterboards.ca.gov/pfas/drinking_water.html

Attachment 1
OPR Recommendations for Additional (in some cases better)
Environmental Justice Tools than CalEnviroScreen

Data Source	Description	Identifying DACs	Pollution Exposure	Public Facilities	Food Access	Safe and Sanitary Homes	Physical Activity	Civic Engagement	Unique Health Risks
The Opportunity Atlas	Based out of Harvard University, this non-profit provides data centered on economic opportunity and upward mobility.								
Urban Footprint	This tool allows jurisdictions to access hundreds of data sets, create maps, and analyze alternative land use scenarios.								
Urban Heat Island Index	The California Environmental Protection Agency maintains this data source to reflect heat islands.								
US EPA's EJSCREEN	This mapping and screening tool contains a nationally standardized dataset with 11 environmental indicators, 6 demographic indicators, and 11 EJ indexes.								
500 Cities-Local Data for Better Health	The Centers for Disease Control maintains health data for the 500 biggest cities across the US, many located in California.								

TOOL INDICATOR COMPARISON TABLE

The following table summarizes the indicators included in each of these assessment tools discussed above, organized by four categories, or factors, of vulnerability (highlighted cells identify which indicators are included in a given tool)⁷. While there are areas of overlap, each tool was designed to inform different decision-making processes and research questions, and as such, any single tool alone will not provide a comprehensive assessment of climate vulnerability. When considering use of the tools in Table 1, the following should be noted:

While indicators may be included in multiple tools, each may use different data sources and timescales; when using multiple tools in an assessment process, users should review the metadata associated with each indicator to identify potential inconsistencies between tools.

■ Table 1 does not reflect all requirements of SB 1000 (Government Code Section 65302(h)) or SB 379 (Government Code 65302(g)), therefore review of the respective sections of OPR’s General Plan Guidelines is important to establish consistency with the underlying statutes.

These “factors” are taken from Planning and Investing for a Resilient California: A Guidebook for State Agencies developed by the Technical Advisory Group for Executive Order B-30-15. <http://www.opr.ca.gov/planning/icarp/resilient-ca.html>

SB 1000 CROSSWALK

The table below also provides a crosswalk between the indicators that are required components of an Environmental Justice Element of a general plan, per Senate Bill 1000 (2016, Leyva). While the other indicators are not required, some may be useful health-related indicators planners may want to consider.

Table 1: Comparison table: indicators currently available through statewide vulnerability assessment tools, organized by system factors

FACTOR	INDICATOR	CES (weighted index + map)	CCHVI (not an index)	HPI (weighted index + map)	ROI (weighted index)	SB 1000
Existing inequities, institutionalized racism, or exclusion: People facing disadvantage or discrimination often have lower socioeconomic status, which result in fewer resources for preparing, coping and recovering from climate impacts.	Educational attainment					■
	Employment					■
	Housing burdened low income households					■
	Income					■
	Linguistic isolation					■
	Poverty					■
	Race and Ethnicity					■
	Two parent household					
	U.S. Citizenship					
	Violent Crime Rate					■
	Voting					
Physical states or conditions that increase vulnerability: Older adults, young children, pregnant women, and people with chronic health conditions or mental illness are more susceptible to harm from effects of climate change.	Asthma emergency department visits					■
	Children					
	Cardiovascular disease					■
	Elderly					

Table 1: Continued

FACTOR	INDICATOR	CES (weighted index + map)	CCHVI (not an index)	HPI (weighted index + map)	ROI (weighted index)	SB 1000
<p>Poor environmental conditions, access to services, or living conditions: Populations at higher risk under a changing climate include those who are uninsured or underinsured or lack access to health care or child care, lack access to transportation, live in areas with poor air quality, live on upper floors of tall buildings, live in areas with lots of impervious surfaces and little tree cover, and lack life-supporting resources such as adequate housing, ways to cool living space, are food insecure or lack adequate medications, or are tenants or renters. Populations at higher risk also include those living in "land islands" that have limited access to resources and services due to conditions of geographic isolation.</p>	Alcohol outlets					■
	Air conditioning					■
	Active commuting					■
	Diesel PM					■
	Groundwater threats					■
	Housing habitability					■
	Hazardous waste facilities and generators					■
	Healthcare availability					
	Housing crowding					■
	Impaired water bodies					■
	Impervious surfaces					
	Ozone concentrations					■
	PM 2.5 concentrations					■
	Park Access					■
	Solid waste sites/facilities					■
	Public transit access					■
	Toxic cleanup sites					■
	Toxic releases from facilities					■
	Traffic density					■
	Tree canopy					■
Retail Density						
Supermarket Access					■	
Use of high-hazard, high-volatility pesticides					■	
Water Contaminants					■	
<p>Lack of investment and opportunities: The disinvestment and resource deprivation historically experienced by communities facing inequities or isolation leads to degraded living conditions and lack of power over decisions that affect their lives</p>	Homeownership					
	Health Insurance					
	Vehicle Ownership/ Access					

Table 2: Summary of additional vulnerability indicators for consideration

DEMOGRAPHICS	Sexual Orientation	
	Homelessness	
	Occupation**†	
	Persons with criminal records	
	Access and functional needs populations**	
	H.S. Graduation Rates/College Degrees*	
	Earning potential vs. job base provided*	
	Population stability*	
	Tribal community demographic data*	
	GDP per capita †	
	Gender †	
	Immigrants †	
	HOUSING SECURITY	Homeowners or renters insurance
Renter population**		
Average property value †		
Homes in flood plains		
Flammable roof, vegetation within 10 meters of home***		
Homes with flood-proofing		
Number, location and population of prisons		
Domestic violence shelters		
Shelters for LGBTQ youth and adults		
Value, quality, and density of residential construction**		
Short-term rental market*		
MOBILITY		Evacuation routes
		"Land island" communities*
HEALTH SERVICES	Individuals with health insurance coverages	
	Persons with substance abuse	
	Mental health services	
	Number of hospitals per capita †	
	Substance abuse services	
	Back up grid energy plans for hospitals*	
	Domestic violence hotline	
	Doctors or nurses per capita	
	Emergency response partnerships with pharmacies/clinics for medication reliant individuals*	
	Distance to critical service providers (isolation factor) *	
	Increasing food costs††	
ENVIRONMENTAL HAZARDS	Adequate/effective sewage/waste management systems	
	Combined exacerbating effects of poor air quality (ozone and PM 2.5) and extreme heat*	
	Smoke from wildfires (controlled and not controlled)*	

Table 2: Continued

EMERGENCY SERVICES	Household knowledge level of disaster resources
	Households with disaster kits
	Household distance to nearest fire station
	Availability of hazmat certification programs
	Hazmat certified individuals
	Potential loss of key infrastructure**
	Disaster plans in place at schools, businesses, churches, etc.
BUSINESS/JOBS	Minority owned businesses
	Businesses with flood proofing\
	Businesses with insurance
	Union jobs
	High density/value commercial and industrial development**
	Amount of Full Time jobs available versus Part Time jobs year round*
	Recreation-based economies susceptible to climate impacts *
PUBLIC/PRIVATE UTILITIES	Telecommunications - availability and access (phone, cable, broadband, etc)
	Households with water/electricity shut offs in last 12 months
	Household that have never been connected to the electricity grid*
	Households reliant on well-water
	Reliance on wood based heat*
	Households & businesses with independent power generation/storage capacity*
SOCIAL SERVICES	Social services-availability
	Services for undocumented persons
	Access to childcare*
GOVERNANCE	Inclusive governance
	Policy or ordinance requiring air conditioners in all single- or multi-family homes*
	Model ordinances addressing urban heat island (cool roofs, cool pavement, etc.)*
	Policy Landscape
COMMUNITY	Neighborhood cohesion
	Financial literacy
	Civic participation †
FISCAL HEALTH	Completion of financial risk assessment*
	Potential loss of employment following a disaster**
	Access to credit ††
CULTURE	Cultural/religious ties to land/water
	Priority on local purchasing & economic development*

Table 2: Continued

EMERGENCY SERVICES	Household knowledge level of disaster resources
	Households with disaster kits
	Household distance to nearest fire station
	Availability of hazmat certification programs
	Hazmat certified individuals
	Potential loss of key infrastructure**
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	Model ordinances addressing urban heat island (cool roofs, cool pavement, etc.)*
	Policy Landscape
COMMUNITY	Neighborhood cohesion
	Financial literacy
	Civic participation †
FISCAL HEALTH	Completion of financial risk assessment*
	Potential loss of employment following a disaster**
	Access to credit ††
CULTURE	Cultural/religious ties to land/water
	Priority on local purchasing & economic development*

SOURCE KEY (SEE REFERENCES FOR FULL CITATIONS)

The basis for this table of indicators can be attributed to the NAACP's Equity in Building Resilience in Adaptation Planning

Additional indicators came from the following:

* Proposed by Technical Advisory Council member or State Agency partner

** Cutter, Boruff, and Shirley, 2003.

*** Cooley, Moore, and Allen, 2012.

† United Nations Development Programme, 2017.

†† Bennett, et al., 2016.