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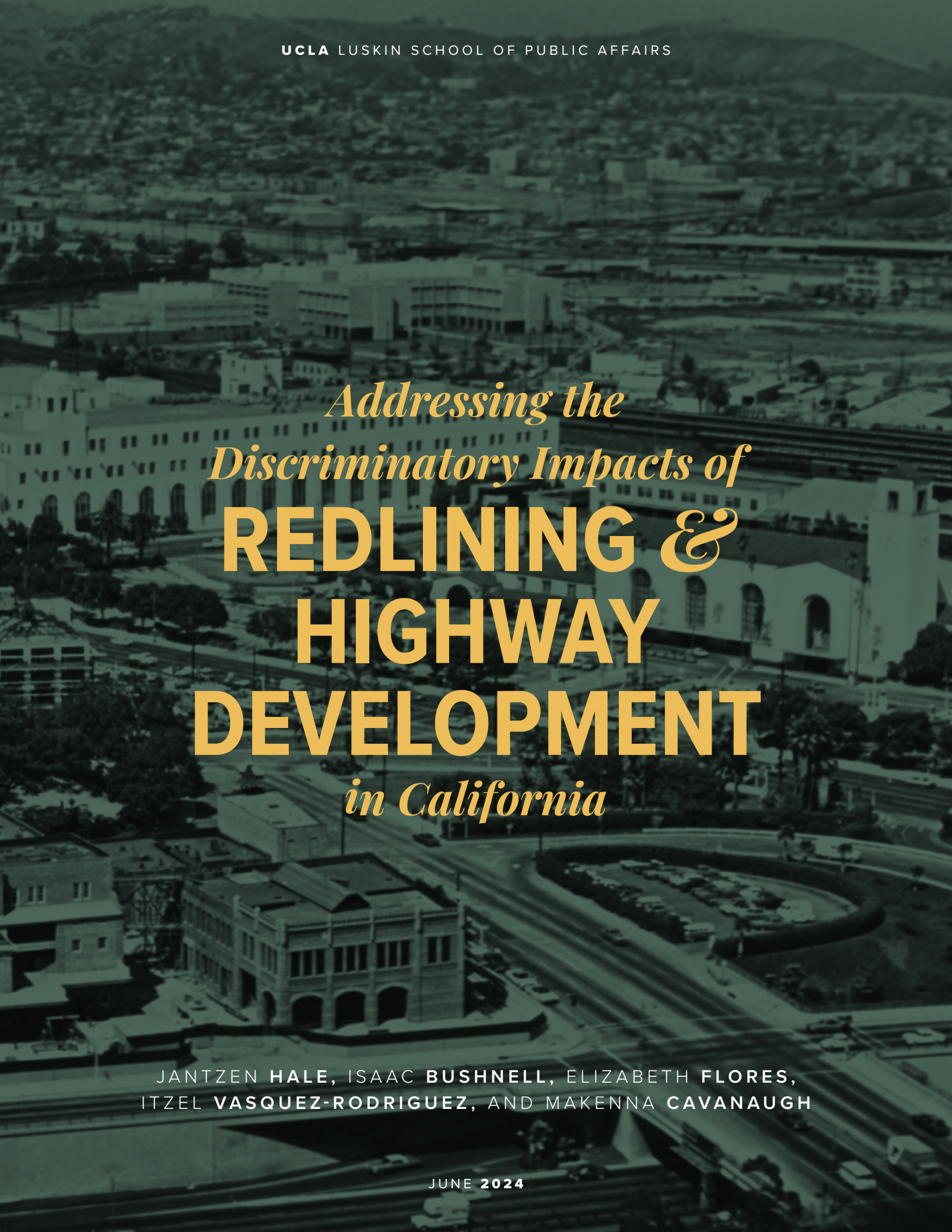

Addressing the Discriminatory Impacts of REDLINING & HIGHWAY DEVELOPMENT *in California*

JANTZEN **HALE**, ISAAC **BUSHNELL**, ELIZABETH **FLORES**,
ITZEL **VASQUEZ-RODRIGUEZ**, AND MAKENNA **CAVANAUGH**

JUNE **2024**

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ACKNOWLEDGMENTS

We would like to thank the following individuals for their support and guidance in the creation of this report:

- **Client Team:** Paula Torrado Plazas, Laura August, Kevin Olp, Jaimie Huynh, and Walker Wieland
- **Informal Advisors:** Tamika L. Butler, Esq., Dr. Lara Cushing, Deputy Executive Officer Chanell Fletcher, Ariana Hernandez, Dr. Michael C. Lens, Deputy Secretary Darwin Moosavi, Dr. Paul Ong, Marina Pérez, Dr. Gregory Pierce, and Dr. Zachary Steinert-Threlkeld

We also wish to thank our advisors and peer reviewers for providing valuable insight that strengthened our report:

- **Advisor:** Dr. Michael A. Stoll
- **Secondary Advisor:** Prof. Michael Masserman
- **Peer Reviewers:** Jala Abner, Sebastian Cazares, Reese Howard, Andrew Rock, and Ana Rodriguez

Finally, we would like to thank the UCLA Luskin Center for Innovation for providing financial support for this project.

Report designed by Lauren Dunlap and copy edited by Miranda Raney.

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DISCLAIMER

This report was prepared in partial fulfillment of the requirements for the Master of Public Policy degree in the Department of Public Policy at the University of California, Los Angeles (UCLA). It was prepared at the direction of the Department and the Office of Environmental Health Hazards Assessment as a policy client. The views expressed herein are those of the authors and may not necessarily reflect those of the Department, the UCLA Luskin School of Public Affairs, UCLA as an institution, or the client.

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EXECUTIVE SUMMARY

This report is a collaboration between the California Office of Environmental Health Hazard Assessment and a research team of graduate students in the Master of Public Policy Program at the UCLA Luskin School of Public Affairs. In this report, we conducted research to understand the intertwined history of redlining and highway development in the state of California, the lasting discriminatory legacies of this history throughout the state, and potential policy solutions to rectify these legacies and advance racial and environmental justice for impacted communities of color. To conclude this research, we analyzed a set of policy options to provide specific recommendations for California State agencies to adopt in order to best achieve these goals.

The report begins with an overview of the history of redlining in California, illustrating how decisions in highway development were built on the policy foundation of redlining to disrupt and dispossess marginalized communities and people of color across the state. With predominantly non-white residential areas in California cities officially redlined as "high-risk" areas due to the race of their residents, federal policy formally recommended the use of highways as physical barriers in those neighborhoods to enforce segregation. Additionally, federal policies incentivized local authorities to concentrate disruptive and high-polluting land uses in redlined communities of color so as not to devalue residential neighborhoods that were not already devalued by redlining. Together, these discriminatory policy practices have saddled generations of non-white Californians with socioeconomic, cultural, and environmental burdens not experienced by their white counterparts. These burdens persist today and are linked to diminished outcomes of health, wealth, happiness, and safety for Californians of color.

This report primarily examines two specific impacts: residential racial segregation and PM2.5 pollution concentration. Through a combination of research, mapping, and statistical analysis, striking evidence emerges of the continued heavy segregation of people of color in previously redlined areas and neighborhoods near highways throughout the state. This trend is mirrored and amplified for the segregation of white people in formerly A-rated areas. Furthermore, a positive correlation between highway proximity and PM2.5 levels is amplified in formerly redlined areas and is indicative of the increased burden of overall pollution faced by these communities in California. The research and analysis that underpin these findings utilize data and historical records from all eight California cities subjected to redlining assessments. Throughout the narrative of this history and mapping of its contemporary impacts, Stockton and Los Angeles serve as case studies.

After illustrating the ongoing discriminatory harms stemming from the history of redlining and highway development in California, the report examines the current policy landscape across the state to identify challenges and opportunities relevant to efforts aimed at addressing these harms. Challenges include the continued dependence on highways and the political divisiveness of policies explicitly focused on racial justice, while opportunities include increased funding for environmental initiatives and growing support for pro-housing, integrated communities across California.

Based on this overview of the policy landscape, the report identifies four distinct policy approaches to address the impacts of redlining and highway development and advance environmental and racial justice in California. These approaches are: 1) Explicitly focusing on race and ethnicity in environmental programs and initiatives; 2) Empowering community input and engagement and increase the decision-making authority of impacted communities; 3) Changing zoning and planning goals and requirements; 4) Making data on equity and environmental justice more accessible to impacted communities and available for community use.

Across these four approaches, the report evaluates 13 different state-level policies for California using a Criteria Alternatives Matrix weighted to reflect these goals. Through this evaluation process, we recommend eight policies for adoption by California State agencies:

RECOMMENDATIONS

CREATE 'OVERBURDENED' POLLUTION STANDARD

The California Environmental Protection Agency (CalEPA) should create a regulatory standard to identify communities overburdened by pollution and require the implementation of land uses that relieve the pollution burden in such communities.

SEGREGATION ELEMENT

Institute a state requirement for formerly redlined cities to include a Segregation Element within their General Plan that establishes strategies to promote integration.

STATEWIDE WAIRE

California Air Resources Board (CARB) should use the South Coast Air Quality Management District's Warehouse Indirect Source Rule as a statewide model to manage emissions and pollution from all high-polluting industrial sources.

HIGHWAY REDESIGN AND TRUCK REROUTING

The California Department of Transportation (CalTrans) should prioritize and fund truck rerouting and highway redesign plans across the state in its 2025 California Transportation Plan update.

DECISION-MAKING POWER FOR IMPACTED COMMUNITIES

The state should entrust decision-making power to formerly redlined communities or communities of color over policies concerning environmental justice and equity.

INCENTIVIZE COMMUNITY INVOLVEMENT

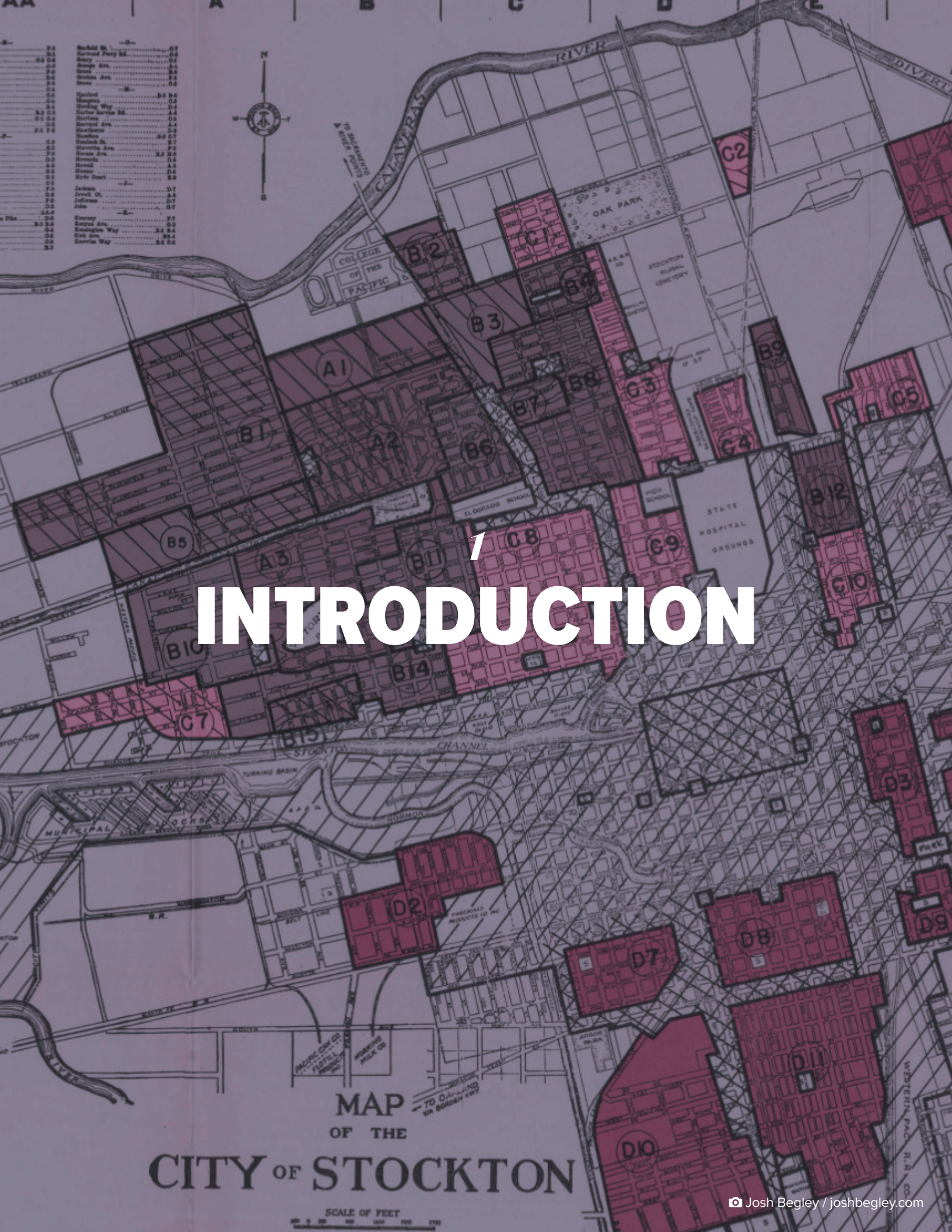
State agencies should systematically incentivize community participation and input around environmental justice policies and initiatives.

40% OF FEDERAL FUNDS INTO COMMUNITIES OF COLOR

State agencies should ensure at least 40% of funds from federal environmental and transportation programs are invested into communities of color.

INCREASE GRANT ACCESSIBILITY

State agencies providing grant funding for environmental justice and racial equity programs should increase accessibility and support for potential grant recipients.



INTRODUCTION

Josh Begley / joshbegley.com


Misterfarmer / Flickr

1. INTRODUCTION

1.1. Project Overview

Across California, people of color disproportionately face crippling burdens of environmental injustice and socioeconomic inequality. These ongoing disparities are firmly rooted in the state's history of redlining, which began in the late 1930s. Redlining was a process by which non-white communities were formally and informally identified as risky, targeted for segregation, and excluded from the benefits of the Federal Housing Authority's Homeowners Loan Corporation Act (HOLC) that helped white communities build wealth. These racist housing and financial policies were the central nodes of a broad policy network that systematically dispossessed non-white people throughout the United States. A connected and integral node in this discriminatory apparatus was a set of racist land use practices in highway development, which were particularly prevalent in California. In building the country's most robust highway system, developers and planners explicitly designed infrastructure that cut through redlined areas, irreversibly disrupting many communities of color and sparking lasting socioeconomic and environmental degradation. While significant research and policy-making efforts have been dedicated to understanding and addressing the impacts of redlining, the intertwined story of redlining and highway development necessitates a more detailed examination.

This project originated from our partners at the California Office of Environmental Health Hazard Assessment (OEHHA) and their desire to better inform the public and state-level policymakers about the history of redlining and highway development and its persisting legacies. An extensive literature review and original data analysis were conducted to construct the story of redlining and highway development in California from the 1930s to the present day. Through an examination of historical trends and new analysis, we identified links to inequitable pollution burdens and residential racial segregation still faced by Californians of color today. Based on these findings and a review of potential

policy options, we designed a variety of state-level policy options to address these discriminatory legacies. In conclusion, the report recommends eight policies that, based on thorough analysis, will meaningfully address these legacies by promoting environmental and racial justice for all Californians.

1.2. Our Client

OEHHA is a state agency within the California Environmental Protection Agency (CalEPA) - see Figure 1 - with a mission to "protect and enhance the health of Californians and the state's environment through scientific evaluations that inform, support and guide regulatory and other actions."[1] OEHHA is responsible for evaluating health risks associated with environmental contaminants and spearheading research efforts to help shape environmental initiatives in California. OEHHA is committed to equitably protecting and advancing the health and well-being of all Californians.

Figure 1: Flowchart of state agencies that comprise CalEPA.[2]

We worked with OEHHA staff members and CalEPA Racial Equity Team members, led by OEHHA's Racial Equity and Environmental Justice Program Manager, Paula Torrado Plazas. This dedicated team consists of members from various departments within CalEPA and is committed to ensuring that the state's environmental efforts acknowledge and adequately address the disparate environmental challenges faced by different communities in the state.[3] Its primary focus involves analyzing environmental racism and advocating for equitable solutions.

1 California Office of Environmental Health Hazard Assessment (OEHHA), "About OEHHA," accessed April 8, 2024, Link.; California Environmental Protection Agency (CalEPA), "About CalEPA," accessed April 8, 2024, Link.

2 California Environmental Protection Agency (CalEPA), "About CalEPA," accessed April 8, 2024, Link.

3 California Environmental Protection Agency (CalEPA), "CalEPA Racial Equity," accessed April 8, 2024, Link.

OEHHA staff members OEHHA / Twitter

The Racial Equity Team operates the Pollution and Prejudice Story Map, which details the relationship between racist policy regimes, such as redlining in California and present-day environmental injustice. The team seeks to incorporate new areas of research into the tool to illustrate this relationship more comprehensively, and this project's research on redlining and highway development will be utilized to further build out this story for the public and decision-makers in state government.

1.3. Policy and Research Design Questions

This project aims to answer the following questions for OEHHA:

- How have redlining and similar discriminatory policy practices in California shaped regional highway development, and what are the consequential impacts on PM2.5 concentration and segregation levels in these communities?
- What policies and interventions can California State agencies advocate for to address these impacts and promote environmental justice and equity?

2

METHODOLOGY

Tony Barnard / Los Angeles Times

Members of the California Strategic Growth Council and California EPA Secretary Garcia meet with implementing partners of Watts Rising, a Transformative Climate Communities grantee organization. 📷 California Strategic Growth Council / Twitter

2. METHODOLOGY

2.1. Methods Overview

First, our team conducted a qualitative literature review to explore the historical intersection between highway development and racist practices related to redlining in California. The review included sources on statewide historical policies and trends, highlighting Stockton and Los Angeles to gain a more nuanced understanding of the issue. The literature review was then used to construct a narrative of the critical aspects and interconnection between redlining and highway development in California, and throughout, specific examples from Stockton and Los Angeles were deployed to enhance the story. We then combined evidence from existing literature with original statistical and geospatial analysis to illustrate and quantify the impacts of this history on PM2.5 pollution burdens and residential racial segregation in California today. Next, we researched and compiled policy options to address such impacts to promote equity and environmental justice. Lastly, we evaluated these policy options using a Criteria Alternatives Matrix and made recommendations for relevant California State agencies.[4]

4 The methods for the policy analysis and recommendations are detailed at the beginning of the Policy Evaluation chapter.

2.2. Establishing the History: Literature Review

To begin the literature review, our team leveraged its UCLA and OEHHA connections to study essential resources needed to examine the impacts of highway development within historically redlined communities in California.[5] Additional networks we would have liked to engage with in this process, had it not been for time and resource constraints,[6] were leaders of community organizations throughout California working to address the legacies of redlining and highway development, as well as community members in Stockton and Los Angeles. This approach would have broadened the perspectives and sources in our literature review, incorporating ideas beyond academia and professional policy circles. Overall, the resources we reviewed included scholarly articles, books, legislation, policy proposals and advocacy, data sets, maps, and other government resources.

Our review of these resources began by focusing broadly on the histories of redlining and highway development. To understand how these racist policies functioned, literature on the nature of racial discrimination and redlining in the State of California from the 1930s-1980s was examined. This time period was selected because the official redlining policies dictated by the Federal Housing Authority (FHA) were in effect from 1936 to the mid-1960s, while policies with similar intent and impact to redlining persisted following the end of redlining as codified law. Additionally, broad trends of highway development throughout the state over time were reviewed. Following this initial review, attention was directed toward sources that specifically addressed the intersection of the two histories. Throughout this research, the links between this history and outcomes of PM2.5 concentration and racial segregation levels in targeted communities were tracked.

2.3. Case Studies: Stockton and Los Angeles

Our team included a case study of two formerly redlined cities as a useful method to illuminate the similarities and differences in these histories for areas with disparate socioeconomic, geographic, and demographic characteristics. Specifically, OEHHA was interested in examining the difference between redlined communities in urban and rural areas of California. Los Angeles was selected because it is the largest and most diverse city in California, serving as the nexus of the nation's largest freeway system and has a wealth of existing research on highway development, redlining, and pollution levels. Stockton was selected because of its rural character, more northern regional location, and demographic diversity. Furthermore, Stockton has been at the forefront of collecting and sharing its pollution and environmental justice data with state agencies, including participation in the state's Transformative Climate Communities initiative.

5 See Appendix 2.1 for sources utilized within each network.

6 Our team had eight months to complete all work for this report, from our formation in September 2023 to the deadline for completion of the report set by UCLA on April 11, 2024.

Based on the findings of this research, examples of neighborhoods, social movements, highway projects, and policies in these two cities were identified, helping uncover the differential impacts of the intersection between highway development and redlining across California.

2.4. Data Analysis: Finding Evidence of Persisting Impact

Following the literature review, data analysis was conducted to augment and address gaps in the existing scholarship on the links between the history of redlining and highway development in California and contemporary issues of racial segregation and PM2.5 pollution concentration. This consisted of spatial analysis to map connections between present-day outcome variables and past discriminatory policies, as well as statistical analysis to isolate significant relationships between outcome variables and relevant historical factors.

ArcGIS Pro was utilized to create maps illustrating the connections among former redlining areas and their proximity to existing highways. Subsequently, contemporary median household income, contemporary racial demographics, and contemporary PM2.5 levels by census tract were layered onto these maps.[7]

Using ArcGIS Pro and data from the United States Census and CalEnviroscreen, we built a dataset containing key variables for all census tracts in California's eight formerly redlined cities. Among the variables in this data set, an index was created to chart the overall highway proximity of each census tract.[8] Moreover, we constructed two sets of multivariate fixed effects regression models to analyze the impacts of redlining and highway development on PM2.5 levels and levels of racial segregation.[9]

Models 1 & 2:

$$pctNwht_{i,c} = \beta_0 + \beta_1 Red_i + \beta_2 Green_i + \beta_3 HWprox_i + a_c + \epsilon_{i,c}$$

$$pctNwht_{i,c} = \beta_0 + \beta_1 Red_i + \beta_2 Green_i + \beta_3 HWprox_i + \beta_4 \mathrm{Red}_i HWprox_i + a_c + \epsilon_{i,c}$$

These models test the links between a census tract's *current non-white population* and its highway proximity and past HOLC risk grade.[10]

Models 3 & 4:

$$PM2.5_{i,c} = \beta_0 + \beta_1 Red_i + \beta_2 HWprox_i + \beta_3 Green_i + \beta_4 PopDens_i + a_c + \epsilon_{i,c}$$

$$PM2.5_{i,c} = \beta_0 + \beta_1 Red_i + \beta_2 HWprox_i + \beta_3 Green_i + \beta_4 PopDens_i + \beta_5 Red_i HWprox_i + a_c + \epsilon_{i,c}$$

7 See Appendix 2.2 for data used for spatial analysis.

8 See Appendix 2.3 for Highway Proximity Index methods.

9 See Appendix 2.4 for more on the process of compiling the data set and variables for regression analysis.

10 See Appendix 2.5 for a full explanation of the design and variables used in Model 1 and Model 2.

These models test the links between a census tract's *current PM2.5 levels* and its highway proximity and past HOLC risk grade.[11]

Using these four models as a baseline, our team ran a total of 20 statistical tests to provide more nuanced quantitative evidence of the legacies of redlining and highway development today in California.[12]

2.5. Generating Policy Options for Evaluation

To finalize the research process, current legislation, initiatives, data, and reporting on the contemporary realities connected to the history of redlining and highway development in California were reviewed. We focused on two central impacts: segregation and PM2.5 pollution. Through this process, our team generated a list of 27 possible policy options to address these ongoing impacts and promote environmental justice. These policy options fit into four general approaches.

- Creating an explicit focus on race and ethnicity
- Improving community empowerment and decision-making authority
- Changing zoning and planning goals
- Making data more accessible

Due to time constraints,[13] a maximum of four policy options within each approach were selected to evaluate as possible recommendations to California State agencies. The final set of policy approaches and options were determined based on OEHHA's level of interest in studying the policy, the specificity of the policy design, the amount of evidence available to analyze the policy, and hypotheses about how each policy will address PM2.5 and segregation levels. Thirteen policy options were evaluated based on these criteria.

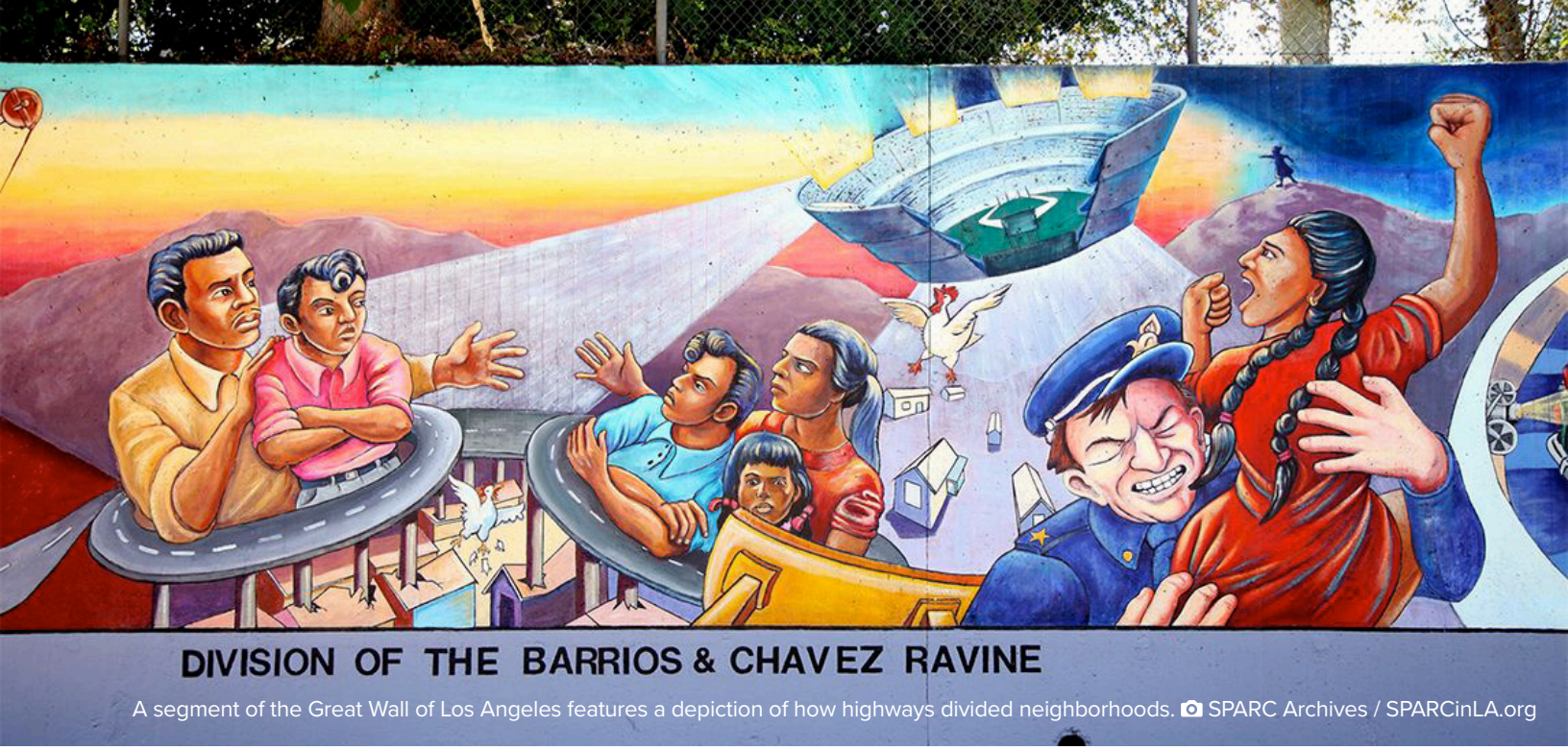
11 See Appendix 2.6 for a full explanation of the design and variables used in Model 3 and Model 4.

12 See Appendix 2.7 for a full explanation of the design and variables used on the 20 statistical tests run on urban and rural areas as well as Los Angeles and Stockton.

13 Our team had eight months to complete all work for this report, from our formation in September 2023 to the deadline of completion of this report set by UCLA on April 11, 2024.

3

PROBLEM IDENTIFICATION



A segment of the Great Wall of Los Angeles features a depiction of how highways divided neighborhoods. SPARC Archives / SPARCinLA.org

3. PROBLEM IDENTIFICATION

3.1. Problem Overview

This chapter details the historical injustices of redlining and highway development in California by exploring their connections to ongoing issues of pollution concentration and racial segregation that disproportionately impact Californians of color. Throughout the chapter, the cities of Stockton and Los Angeles serve as case studies to illustrate localized examples of this history and its consequences.

3.2. Redlining

What was Redlining?

While the term “redlining” is now broadly used to refer to all systems of discrimination targeting neighborhoods of color, it is crucial to pinpoint the origins of the term in federal housing policy to illuminate its intertwined history with highway development in California. Redlining was first established by the FHA in response to the HOLC. The HOLC aimed to provide security to a fragile national mortgage market amid the Great Depression by offering Americans favorable, low-interest loans to purchase new homes backed by federal government funds. To limit the risk of people defaulting on these loans, the FHA developed criteria to assess relative lending risk on a neighborhood-by-neighborhood basis. Throughout the late 1930s and early 1940s, HOLC task forces visited American cities with populations of more than 40,000 people to create maps that applied this criterion locally. In classifying neighborhood risk on a four-part scale from A (“Best”) to D (“Hazardous”), these

government agents factored in the race and ethnicity of residents, as mandated by official FHA policy.[14] Areas inhabited by "inharmonious racial or nationality groups"[15] were deemed riskier and were more likely to be assigned "D" ratings, meaning they were outlined in red – or "redlined" – on official HOLC maps. Assessors, particularly for the eight redlined cities in California, identified almost every racial and ethnic group except for non-Hispanic white individuals as carrying these inharmonious and subversive influences.

Through this explicitly racist policy, the FHA and collaborating local authorities across the United States artificially lowered property values in predominantly non-white neighborhoods and ensured only 2% of the $120 billion in federal home loans went to non-white Americans.[16] This policy systematically deprived people of color in America of wealth and opportunity while explicitly promoting segregation as a goal of federal housing policy. The FHA official manual in 1936 stated:

> *"Areas surrounding a location are investigated to determine whether incompatible racial and social groups are present, for the purpose of making a prediction regarding the probability of the location being invaded by such groups. If a neighborhood is to retain stability, it is necessary that properties shall continue to be occupied by the same social and racial classes. A change in social or racial occupancy generally contributes to instability and a decline in values."*[17]

This guidance established that integrated neighborhoods were more likely to be redlined, thus incentivizing public and private collaboration to force residents of color out of integrated neighborhoods and into devalued homes in segregated neighborhoods.

Following pushback from civil rights organizers, the FHA removed explicit references to race and ethnicity in its 1947 and 1958 manuals. However, it substituted those references with thinly veiled terms intended to uphold the same discriminatory policies rather than redressing the racial inequality explicitly sowed in federal housing policy; these changes encouraged government officials to continue perpetuating such disparities in practice.[18]

Redlining in California

Stockton, Los Angeles, San Diego, Fresno, Sacramento, San Jose, Oakland, and San Francisco were the eight cities in California redlined by the federal government. The official HOLC evaluations of Stockton and Los Angeles serve as prime examples of the explicit racial discrimination factored into exclusionary classifications throughout the state.

14 "Pollution and Prejudice - Redlining and Environmental Justice in California," Pollution and Prejudice, August 16, 2021.

15 "Federal Housing Authority Underwriting Manual" (1938).

16 "Pollution and Prejudice - Redlining and Environmental Justice in California," Pollution and Prejudice, August 16, 2021.

17 "Federal Housing Authority Underwriting Manual" (1938).

18 Richard Rothstein, The Color of Law: A Forgotten History of How Our Government Segregated America (First edition; New York: Liveright Publishing Corporation, a division of W.W. Norton & Company, 2017).

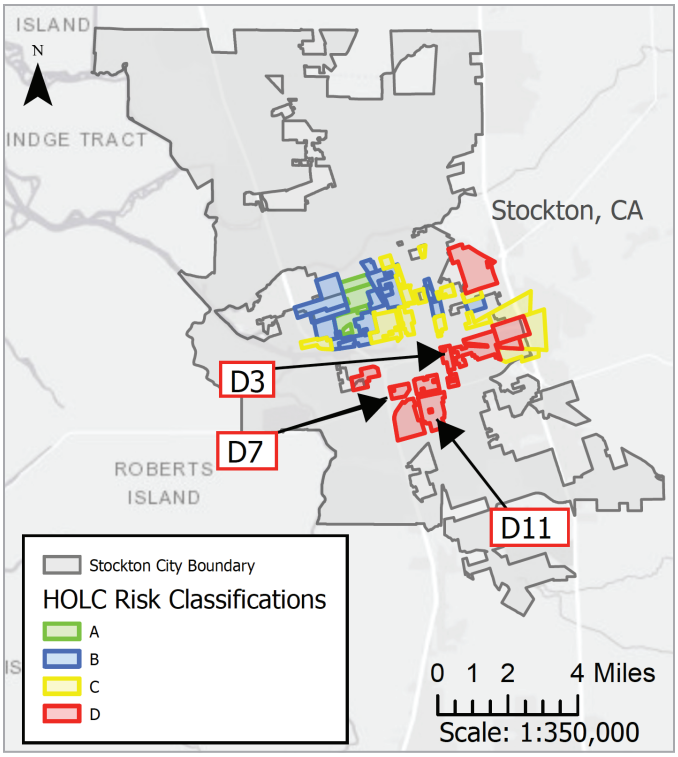


Figure 2: Map of modern-day Stockton, CA, overlaid with 1939 HOLC risk classifications.

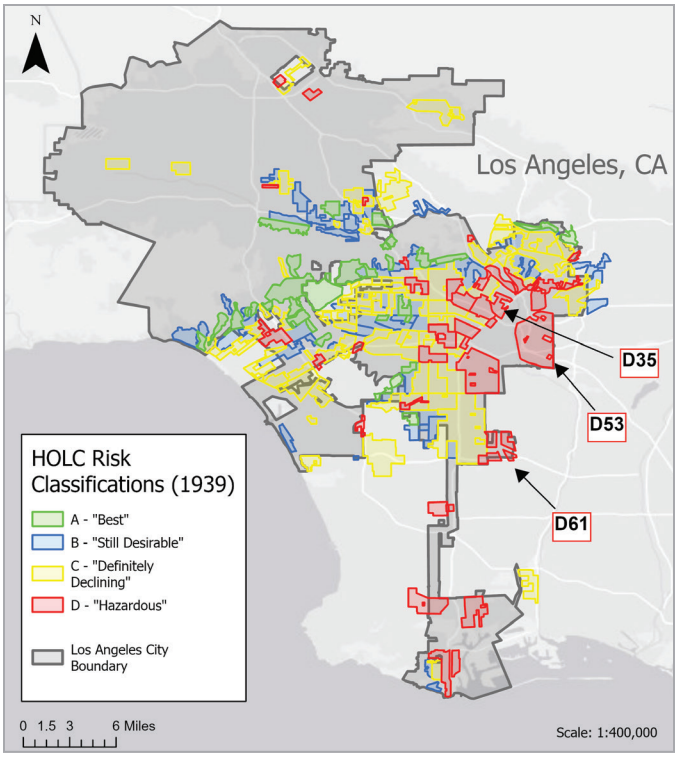


Figure 3: Map of modern-day Los Angeles, CA, overlaid with 1939 HOLC risk classifications.

Figure 2 depicts the 1939 HOLC areas in Stockton. Government officials noted that Homestead (Area D11) would have received a "C" rating were it not for "subversive racial influences in the area." For Barrio del Chivo (Area D3), officials logged that "subversive races exist [as] there is a concentration of Mexican residents in the area as well as many negroes and orientals." As a result, the area was deemed "low red" and "an area to develop into a business or industrial section." In Japantown and Chinatown (Area D7), officials noted the "well-improved streets" and "proximity to recreational centers," but overrode these positives due to their perception that "the area is infested with subversive racial influences [of] Chinese merchants and Japanese farmers and laborers" and duly redlined it.[19]

In Los Angeles, risk assessors redlined large swaths of East and Central Los Angeles due to its concentration of non-white residents. In Elysian Park (Area D35 in Figure 3 and present-day home of Dodger Stadium), officials declared that "racial hazards are so great that higher than 'medial red' could not be assigned." In Boyle Heights (Area D53), assessors praised the community's "conveniently available schools, churches, trading centers, recreational areas, and transportation." Yet, the same assessors could not overlook that the area was "literally honeycombed with diverse and subversive racial elements" such as "American Mexicans, Japanese, and ... negroes" and redlined it. In Watts (Area D61), the district was noted as "the largest concentration of negroes in Los Angeles County" and flagged with a "low red" grade.[20]

19 "Home Owners' Loan Corporation Act Assessment - Stockton, California (1939)," Mapping Inequality: Redlining in New Deal America, 2023.

20 *Ibid.*

These examples of the language that dictated official government housing policy starkly illustrate that the race and ethnicity of Californians were not just considered in decisions about which neighborhoods were riskier to invest in, but were a leading factor in government decisions to systematically deny benefits to Californians of color, devalue their property, and segregate them into dispossessed communities.

Lasting Impacts of Redlining

Examining the racial wealth gap in relation to formerly redlined areas reveals some of the fundamental impacts of redlining. Some of the more elemental tolls of redlining can be charted by looking at the racial wealth gap in relation to formerly redlined areas. Data from the University of Richmond indicates that, across the 200 U.S. cities that received HOLC assessments in the 1930s and 1940s, median household income in formerly redlined areas was only 70% of that in non-redlined areas of the same cities.[21] In California, nearly half of the population in redlined neighborhoods (46%) currently live below the poverty line— a rate 40% higher than the average poverty rate for residents of non-redlined parts of the state's eight HOLC-assessed cities.[22]

Furthermore, it is evident that more than 80 years after the advent of redlining policies and more than 50 years after their formal abolition, these wide disparities in outcomes are disproportionately experienced by populations of color who still predominantly reside there.[23] Just 31% of the 11 million residents of these areas across the country identify as non-Hispanic white, compared to 58% of the city-dwelling U.S. population overall.[24] [25] In California, non-Hispanic white individuals make up just 18% of residents in formerly redlined areas, compared to 67% of residents in formerly A-rated areas.[26]

A city-level examination of Los Angeles exemplifies the reality that people of color, both nationwide and in California, are still concentrated in formerly redlined areas, while wealth is concentrated elsewhere.

Figures 4 and 5 depict the striking disparity in wealth distribution within formerly redlined areas in Los Angeles. Census tracts in the city's lowest quartile for median household earnings strongly correlate with formerly D-rated areas, while wealth is concentrated in

21 Andre M. Perry and David Harshbarger, "America's formerly redlined neighborhoods have changed, and so must solutions to rectify them," October 14, 2019, The Brookings Institution

22 See Appendix 3.1.

23 Paul Ong, Ananya Roy Yoon, and Chhandara Pech, "Redlining and Beyond: Development Within and Outside HOLC Spaces in Los Angeles County" (Los Angeles: UCLA Center for Neighborhood Knowledge, 2023), accessed April 8, 2024, **Link**.

24 Andre M. Perry and David Harshbarger, "America's formerly redlined neighborhoods have changed, and so must solutions to rectify them," October 14, 2019, The Brookings Institution

25 United States Department of Agriculture Economic Research Service, "Percent of Urban and Rural Populations by Race/Ethnicity," October 13, 2020

26 Anthony Nardone, et. al., "Associations between historical residential redlining and current age-adjusted rates of emergency department visits due to asthma across eight cities in California: an ecological study," *The Lancet Planetary Health Journal*, Vol. 4, Issue 1, January 2020, Pages e24-e31

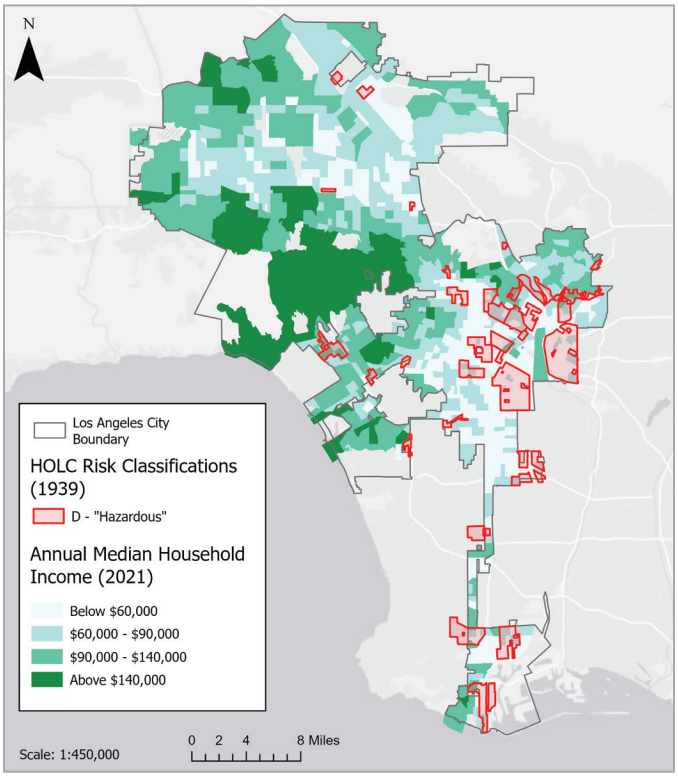


Figure 4: Map of Median Household Income by Census Tract in Los Angeles, CA (2021), overlaid with 1939 HOLC risk classifications **(redlined areas)**.

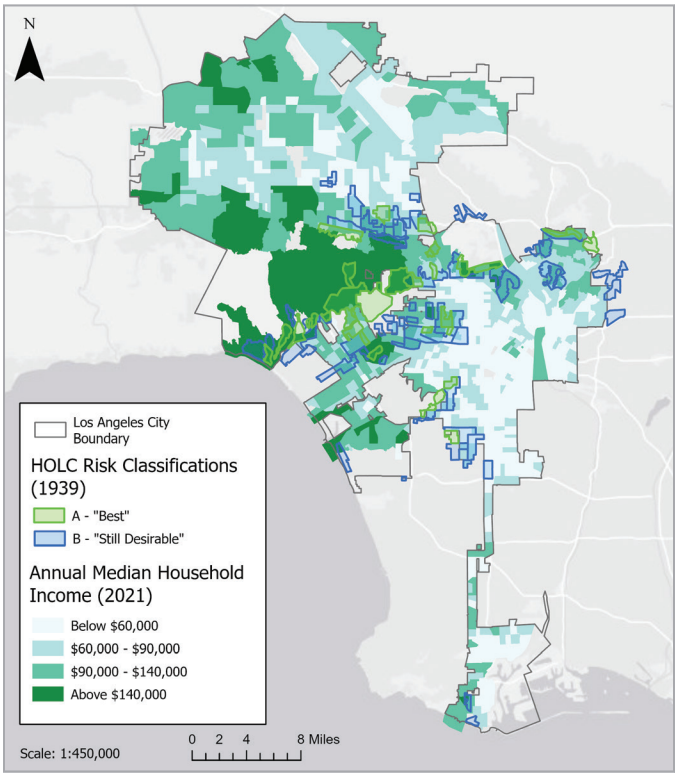


Figure 5: Map of Median Household Income by Census Tract in Los Angeles, CA (2021), overlaid with 1939 HOLC risk classifications **(A and B-rated areas).**

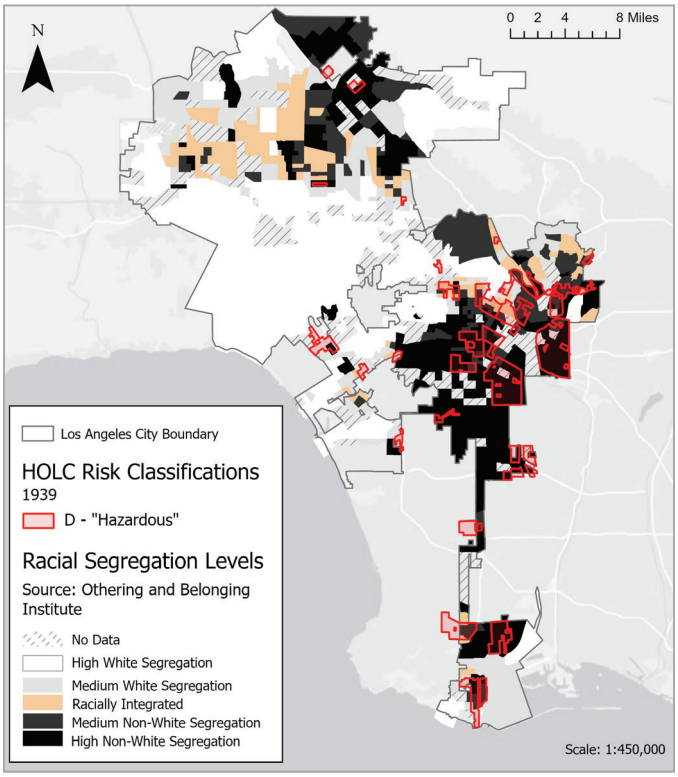


Figure 6: Maps of Segregation Levels by Census Tract in Los Angeles, CA (2021), overlaid with 1939 HOLC risk classifications **(redlined areas)**.

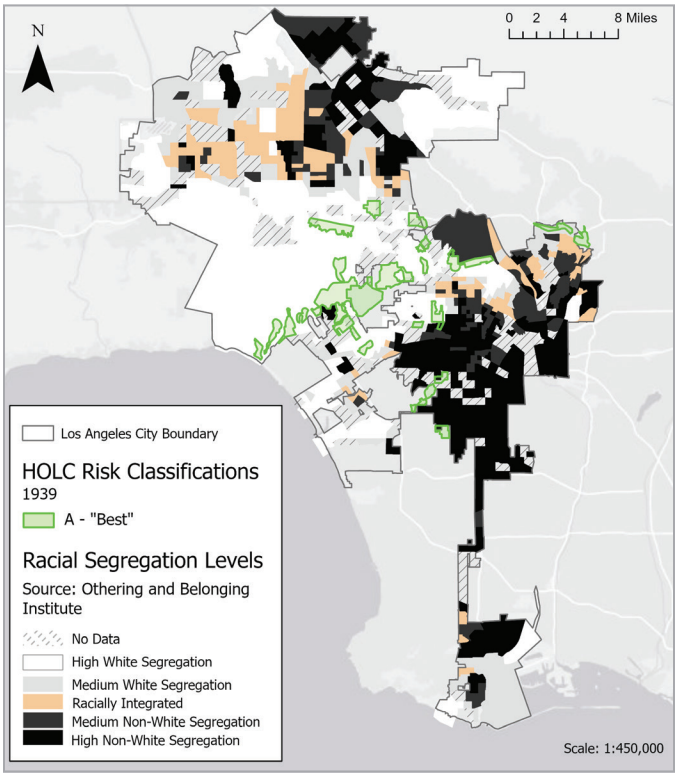


Figure 7: Maps of Segregation Levels by Census Tract in Los Angeles, CA (2021), overlaid with 1939 HOLC risk classifications **(A-rated areas)**.

formerly A-or-B-rated areas. Similarly, Figures 6 and 7 show a strong connection between redlining and present-day racial segregation.[27] Formerly A-rated areas overwhelmingly overlap with census tracts where white individuals are segregated, whereas formerly D-rated areas overlap with areas where non-white populations are segregated. Another notable trend in Los Angeles is the demographic shift occurring in many of these redlined areas – from predominantly Black to predominantly Latine and vice versa – since the 1940s. However, this shift has not altered the reality that dispossessed communities of color are still highly segregated in these underserved areas.[28]

While redlining has served as the policy foundation for lasting discrimination and dispossession of people of color in California and nationwide, the state's history of robust highway development generated further discriminatory impacts for non-white communities.

3.3. Highway Development in Redlined Communities

Regional Highway Development in California

The establishment of the California State Highway System and The Bureau of Highways in 1895 marked the beginning of the State's unprecedented commitment to highway infrastructure. The development of highways and roads was slow and underfunded until the Collier Burns Act of 1947 increased gas and diesel taxes to help fund highway construction. Initiated the same year, the California Master Plan designed a comprehensive system of interconnected freeways to meet the State's evolving transit needs. The Collier Burns Act influenced President Eisenhower's 1958 Federal-Aid Highway Act, creating a gas tax and trust fund that accelerated highway projects. This shift to state and federal funding of highways transformed California's highway and freeway development.[29]

However, this windfall of funding for the expansion of highway development triggered backlash. The following decade was characterized by the freeway revolts, a period of widespread protests across the U.S. to force planners to consider the impacts of development projects on communities. Revolts were predominantly successful in white communities, but bulldozed in communities of color. In the 1960s and 1970s, highways contributed to suburbanization trends, leading to lower land values and population loss in urban neighborhoods.[30] From the 1980s onward, the State focused on modifying and expanding existing roads to meet its changing transportation needs and challenges.[31] Today, California's expansive road network continues to be a vital component of its identity and economic vitality. Highways remain integral to land use and transportation

27 Data Source for segregation levels: Stephan Menendian, Samir Gambhir, and Arthur Gailes, "The Roots of Structural Racism Project," The Othering and Belonging Institute, June 21, 2021.

28 Stephan Menendian, Samir Gambhir, and Arthur Gailes, "The Roots of Structural Racism Project," The Othering and Belonging Institute, June 21, 2021.

29 California, State Of. "Caltrans History | Caltrans," n.d.

30 Mohl RA. The Interstates and the Cities: The U.S. Department of Transportation and the Freeway Revolt, 1966–1973. Journal of Policy History. 2008;20(2):193-226.

31 California, State Of. "Caltrans History | Caltrans," n.d.

systems in the movement of people and goods.[32] The legacy of these highways extends beyond physical infrastructure: they shaped urban landscapes, influenced demographic patterns, and contributed to conversations about equitable development. As California grapples with evolving transportation challenges and considers sustainable options for the future, the history of its highway development becomes a basis for conversations about the future of highways and addressing past racial injustices.

Targeting Redlined Communities for Highway Development

To develop vast highway networks in California, state and local governments needed to identify suitable land for efficient route construction while mitigating negative impacts on land use patterns. With the help of federal directives from the FHA, one of the main strategies they resorted to was constructing highways in redlined communities when traversing residential areas.[33] Today, 77% of redlined areas across California have highways bordering or bisecting them, compared to just 49% of all other HOLC-assessed areas.[34] At the census tract level, tracts in formerly redlined areas across California have roughly twice as many highways within 0.75 miles of them as formerly A-rated tracts and are roughly twice as close to the nearest highway on average.[35] These statistics are blatantly reinforced by maps of California's redlined cities that overlay highways with historic HOLC risk classifications. Figures 8 and 9 depict the phenomenon in Stockton and Los Angeles, while Figures 10 and 11 provide further examples of Fresno and San Francisco to reinforce the pervasiveness of this practice in redlined areas across the state.

These policy decisions to route highways through redlined areas were motivated by two central factors rooted in the FHA's Underwriting Manual. The first was the desire of local authorities to confine land use or development associated with pollution or poor air quality to areas of cities and regions that had already been redlined. The criteria used in the HOLC assessment to categorize neighborhood risk incentivized compounding risk in redlined areas. In addition to considering the race and ethnicity of an area's residents, the HOLC assessment also decreed that the "presence of smoke, odors, or fog" in the area should also inform a neighborhood's risk categorization.[36] With predominantly non-white neighborhoods in cities already redlined as "hazardous" on account of their racial and ethnic makeup, local authorities were motivated to locate any land uses associated with negative environmental outputs in or near redlined communities for years to come in order to avoid the devaluation of A and B-rated areas. Due to the noise, smells, and smog associated with them, highways fell into this category of land uses and were consequently built through redlined areas.[37]

32 California Department of Transportation, 2022 Caltrans Facts, accessed April 8, 2024, **Link**

33 "Pollution and Prejudice - Redlining and Environmental Justice in California," Pollution and Prejudice, August 16, 2021.

34 See Appendix 3.2.

35 See Appendix 3.3 and 3.4

36 "Federal Housing Authority Underwriting Manual" (1938).

37 "Pollution and Prejudice - Redlining and Environmental Justice in California," Pollution and Prejudice, August 16, 2021.

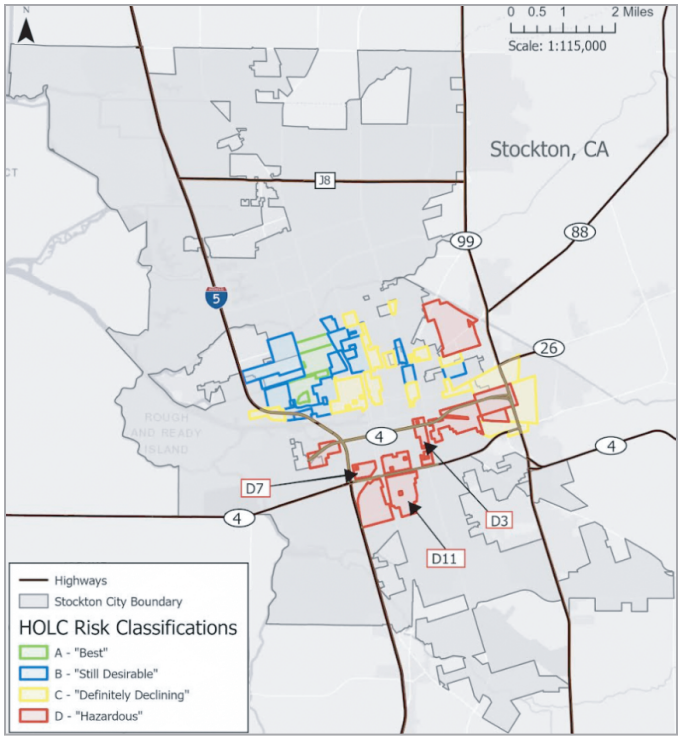


Figure 8: Map of modern-day Stockton, CA (highways in brown), overlaid with 1939 HOLC risk classifications.

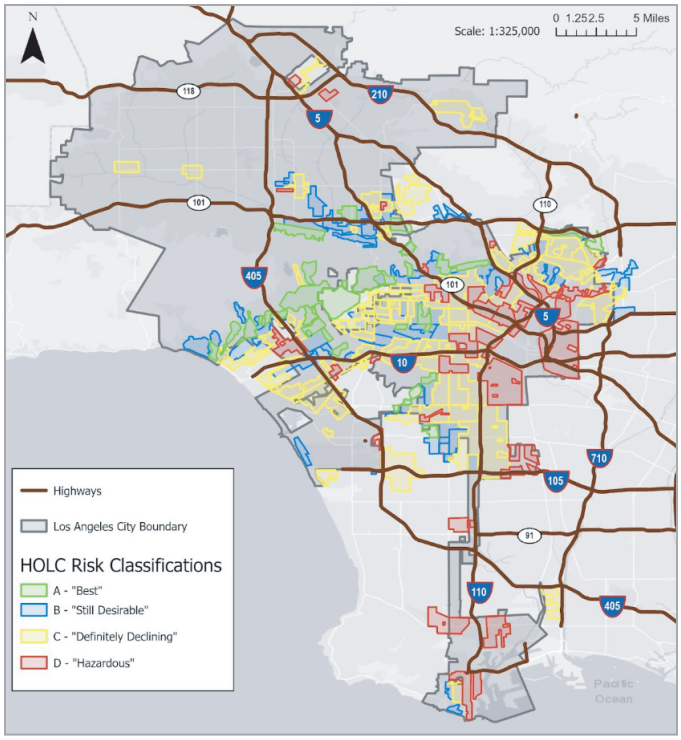


Figure 9: Map of modern-day Los Angeles, CA (highways in brown), overlaid with 1939 HOLC risk classifications.

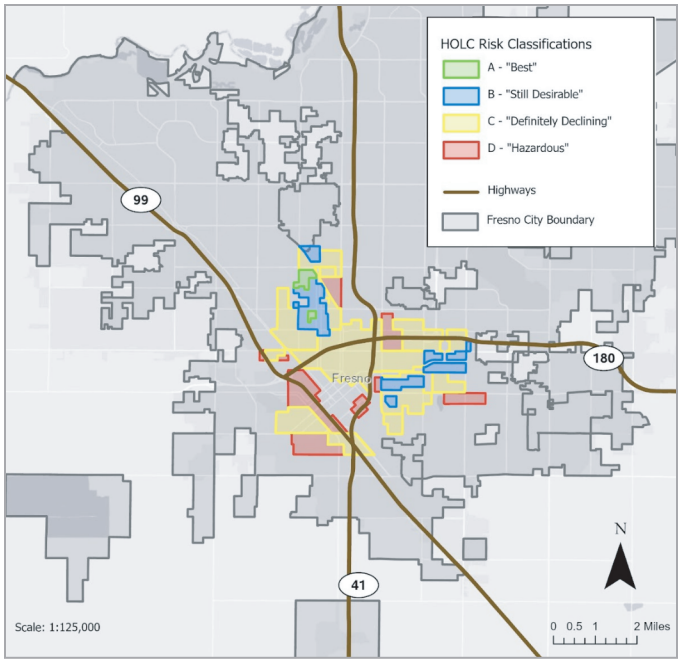


Figure 10: Map of modern-day Fresno, CA (highways in brown), overlaid with 1939 HOLC risk classifications.

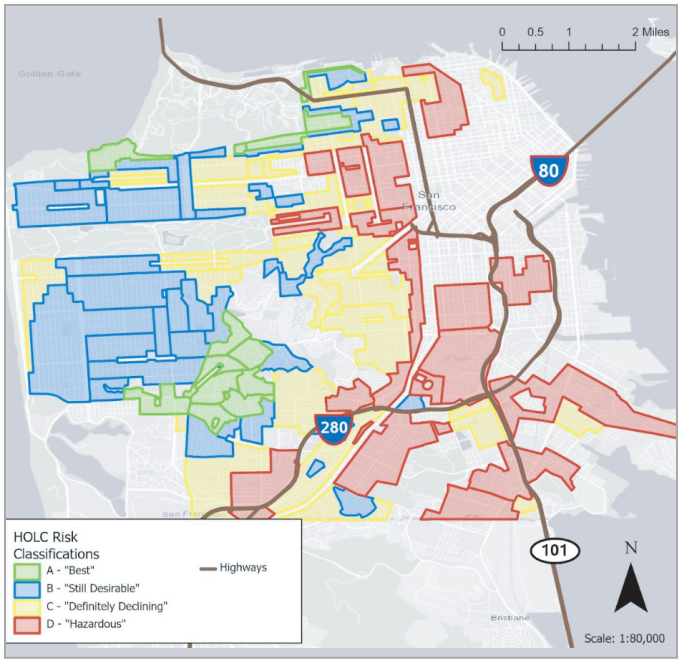


Figure 11: Map of modern-day San Francisco, CA (highways in brown), overlaid with 1939 HOLC risk classifications.

The second factor was the explicit recommendation of the FHA to use "high-speed traffic arteries" as a land use tool to "prevent the expansion of inharmonious uses to the other side of the street."[38] Having already established that they viewed the coexistence of different racial groups in the same residential area as an "inharmonious use" of land, this section of FHA guidance created a precedent for local authorities to use highways as a barrier to enforce segregation between white communities and redlined communities of color. Since the interstate highway system began to take shape after the first Federal Highway Act of 1956 and after the Supreme Court struck down traditional tools of segregation, highways held the capacity to continue the de facto enforcement of racial zoning lines to keep racial groups segregated. Throughout California, officials leveraged this capacity and routed highways to curb the physical and socioeconomic mobility of people of color and preserve wealth for white spaces.

Discrimination and Displacement in Los Angeles & Stockton

Case studies of Los Angeles and Stockton illustrate the profound consequences and destruction of communities of color wrought by the development of highways in redlined areas. Throughout Los Angeles, highways "worked to hide the brutal violence of racial segregation and also helped to maintain it."[39] In 1968, the Century Freeway displaced 3,550 families, 117 businesses, and numerous parks, schools, and churches, primarily in Black Watts and Willowbrook.[40] CalTrans encouraged those who could do so to leave, forced residents out by eminent domain, or trapped remaining residents in bisected communities that were maintained through racial covenants.[41] In Boyle Heights, a thriving Mexican-American and Mexican immigrant community, residents were displaced by six freeways despite their activism. Some residents with the ability to leave left the area, while the acceptance of relocation assistance by poorer residents was misinterpreted by planners as an endorsement for the highways.[42] Sugar Hill, formerly known as West Adams Heights, was once the wealthiest Black neighborhood in the city of Los Angeles before CalTrans utilized eminent domain to construct the I-10 freeway and reinforce segregation.43 Despite protests from Sugar Hill residents, the choice between the freeway cutting through the University of Southern California's (USC) fraternity and sorority row or destroying Sugar Hill led to the destruction of Sugar Hill, while USC's Greek row remained intact as shown in Figure 12.

38 "Federal Housing Authority Underwriting Manual" (1938).

39 Archer, D. N. (2020). "White Men's Roads Through Black Men's Homes": Advancing Racial Equity Through Highway Reconstruction. Vanderbilt Law Review, 73(5), 1259–1330."

40 Mohl, RA *supra note* 27.

41 Lutenski, E. (2019). Dickens Disappeared: Black Los Angeles and the Borderlands of Racial Memory. American Studies (Lawrence), 58(3), 15–35. **Link**

42 Other non-white neighborhoods impacted by freeways in Los Angeles include Lincoln Heights, Watts, and Wilmington. See Jaffe, Eric. "The Forgotten History of l.a.'s Failed Freeway Revolt." Bloomberg. Com, Bloomberg, 23 July 2014.

43 This came after an unsuccessful attempt to evict Black families through a court case focused on enforcing racial covenants, see Susaneck, Adam Paul. "Sugar Hill." SEGREGATION BY DESIGN, **Link**. Accessed 2 Jan. 2024.

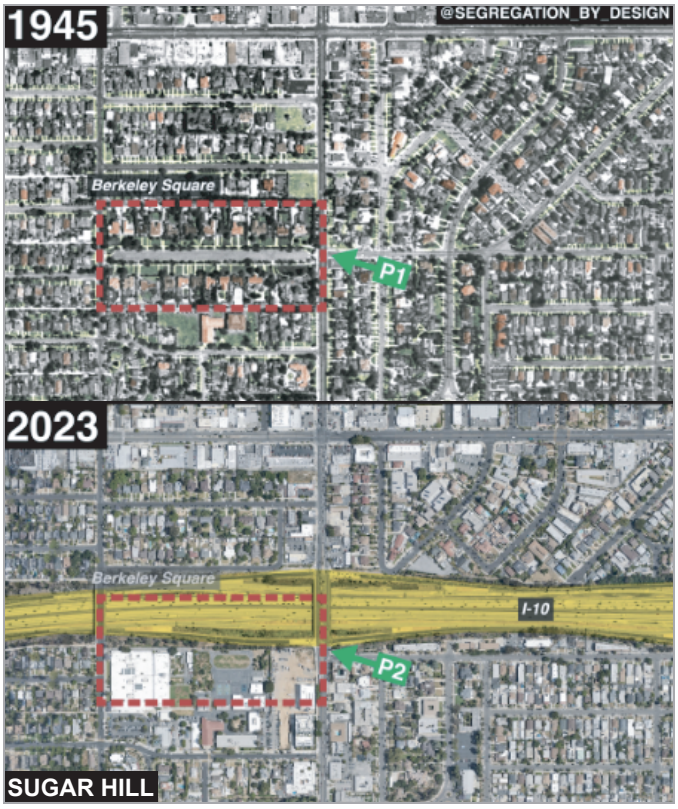


Figure 12: Map of Sugar Hill, South Los Angeles, illustrated in red before and after highway construction.

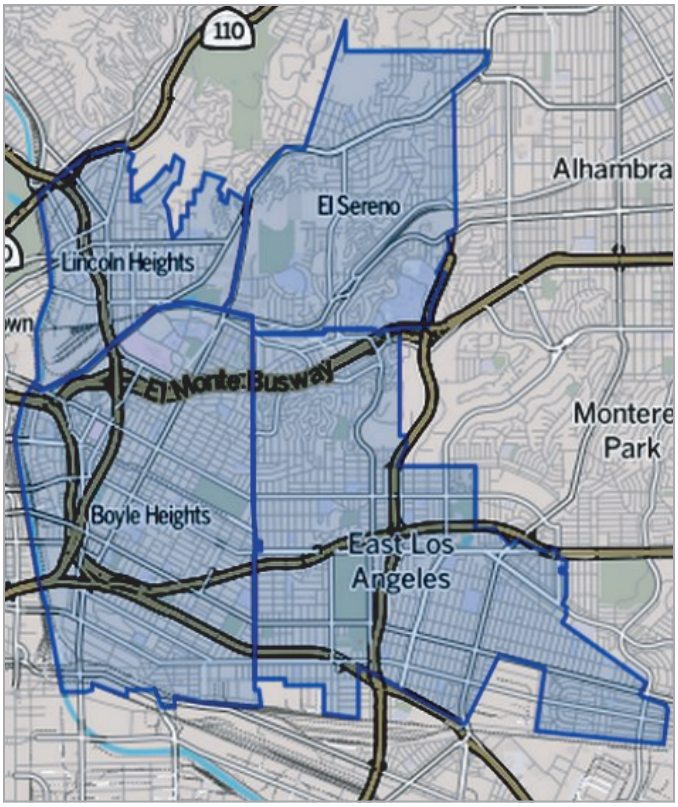


Figure 13: Map of East Los Angeles neighborhoods affected by highway development.

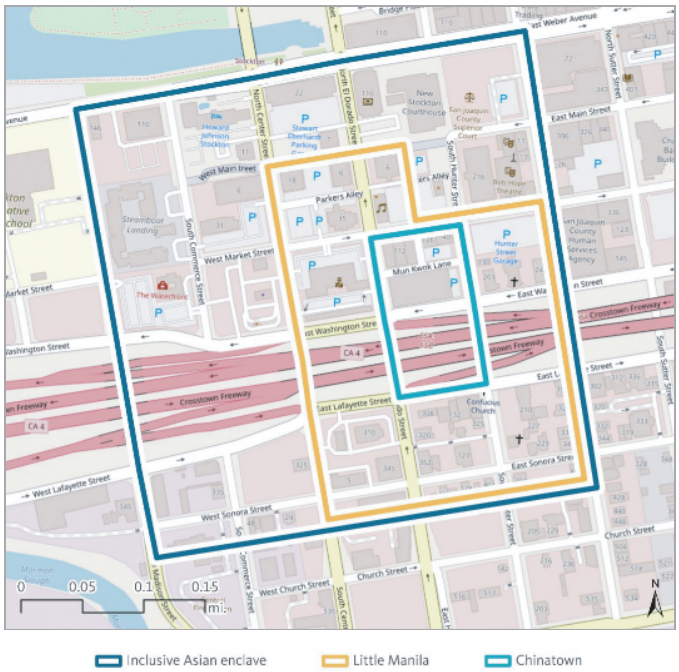


Figure 14: Map of Highway 4 cutting through Stockton's Asian enclaves.[44]

44 Ong, P. M., Pech, C., Do, C.-H., Yoon, A., & Wasserman, J. L. (2023). Stockton's Crosstown Freeway, Urban Renewal, and Asian Americans: Systemic Causes and Impacts.

Los Angeles's 1958 Master Plan is marked by the absence of freeways slicing through predominantly white neighborhoods.[45] Freeway revolts in Beverly Hills successfully resisted the proposed Beverly Hills Freeway, while similar efforts in Boyle Heights failed to prevent the construction of six freeways.[46] Compared to the 2.4% of the land used for freeways in Los Angeles, East Los Angeles saw 9.3% and Boyle Heights 12% of its land taken by freeways as seen in Figure 13.[47] While the freeway revolts eventually spurred federal policy changes in 1965 that prioritized local input, these changes arrived too late for most or were implemented despite opposition from communities of color.[48]

In Stockton, the scenario was no different— low-income communities were subject to extensive demolition. Stockton's 1958 Master Plan for Highway 4 routed through "blighted" areas of racial enclaves for "slum clearance," destroying neighborhoods like Little Manila and Barrio del Chivo,[49] and impacting Chinatown and Japantown, as seen in Figure 14. Little Manila was once the largest Filipino community outside the Philippines.[50] Barrio del Chivo was a mainly Mexican and Black neighborhood and government officials determined that "the best that can be hoped for in this area, is that it [is] develop[ed] into a business or industrial section" and graded it as a low red area optimal for highway development.[51] Neighborhoods utilized a range of responses to evade negative community impacts but were dismissed or ignored by city officials. Residents from Barrio del Chivo tried to secede from the City of Stockton to avoid demolition. The appeal failed, leading to its residents relocating and the community being destroyed. Organized resistance in Little Manila challenged displacement and redevelopment but faced two unsuccessful court challenges, one of which was predetermined by the city government. Ultimately, the Crosstown Freeway's construction "displaced more than 1,000 people and destroyed nearly 800 housing units," impacting mainly people of color.[52]

45 "Hidden Long-Term Effects on the Latino Community of East Los Angeles." Foundations of Law and Society (blog). Accessed April 8, 2024. **Link**.

46 Other wealthier areas like Westwood and West Hollywood that also resisted the thwarted Beverly Hills Freeway reaped the benefits. Gamboa et al., 2021

47 Levine, Jonathan. "Justice and the Interstates: The Racist Truth about Urban Highways, Edited by Ryan Reft, Amanda K. Phillips de Lucas, and Rebecca C. Retzlaff: Washington, DC, Island Press, 2023." Journal of Urban Affairs, (2023), 1–2. doi:10.1080/07352166.2023.2217045.

48 Communities of color in LA were also further impacted by projects outside of Los Angeles, as the 69 highway displaced over 4,000 Black and Mexican-American residents from Pasadena into inner-city Los Angeles communities. Mohl, RA *supra note* 27.

49 Ong, P. M., Pech, C., Do, C.-H., Yoon, A., & Wasserman, J. L. (2023). Stockton's Crosstown Freeway, Urban Renewal, and Asian Americans: Systemic Causes and Impacts.

50 Planners used highway development in tandem with the urban renewal West End Redevelopment Project to achieve this. Through parcel land grabs, eventually Little Manila was completely destroyed. Mabalon pg. 271

51 This designation and later "slum" identification would lead to a comprehensive land grab and destruction of the neighborhood. Madrigal-Lauchland, Vanessa. "The Shifting Meanings of Stockton's Barrio del Chivo." California History 96 (2019): 97-100. **Link**.

52 Ong, P. M., Pech, C., Do, C.-H., Yoon, A., & Wasserman, J. L. (2023). Stockton's Crosstown Freeway, Urban Renewal, and Asian Americans: Systemic Causes and Impacts.; *Ibid*.

In both cities, communities experienced displacement at the hands of local governments through eminent domain, either through comprehensive land grabs or through parcel land grabs. Parcel land grabs caused lasting damage as homes, community centers, and businesses were destroyed, notably in Chinatown in Stockton and Sugar Hill in Los Angeles. In Los Angeles, city officials justified building through redlined neighborhoods by citing low construction costs and the need to preserve industrial sites. City government officials in Stockton openly used highway development to "wipe clean" areas with Asian racial enclaves.[53] Through eminent domain, city governments provided relocation incentives, offering alternative housing options in temporary camps along with compensation for lost housing. However, these alternatives fell short, providing inferior living conditions to residents' original homes and inadequate compensation for new housing costs.[54] Following pushback from civil rights organizers, the FHA removed explicit references to race and ethnicity in its 1947 and 1958 manuals. However, it substituted those references with thinly veiled terms intended to uphold the same discriminatory policies.

3.4. Impacts of Highway Development and Redlining in California

The impacts of highway development history reach far beyond physical infrastructure, encompassing vast environmental, socioeconomic, and sociocultural implications. Due to this project's time constraints and OEHHA's priorities, our team focused its analysis on two main impacts: racial segregation and particulate matter (PM) pollution above 2.5.

Racial Segregation

Racial segregation is the degree to which individuals are concentrated into distinct areas, institutions, or groups based on their different racial identities. In the context of historical redlining, however, racial segregation focuses on housing segregation and the degree to which individuals outside the non-Hispanic white racial group are concentrated in distinct residential areas. While acknowledging the existence and importance of segregation between different racial groups of color, prioritizing the binary of white and non-white mirrors the designations of "inharmonious racial or ethnic groups" used by the FHA.

Understanding the importance of studying racial segregation levels requires highlighting the inevitable negative impacts of segregation on people of color and society as a whole. From an institutional perspective, racial segregation allows for the continued implementation of policies that can be race-neutral in language but racially discriminatory in practice. When people of color are concentrated in specific residential areas with particular levels of wealth and political capital, policymakers can enact measures that

53 This divide is further demonstrated by officials and white neighborhoods labeling Asian neighborhoods as Skid Row while residents referred to the area as the West End. Ong et al. *supra note* 46.

54 In rural Stockton, homes were on average estimated to be around $8,500 in Little Manila and Chinatown, but residents received only $3,000 for their homes. In some urban areas like Sugar Hill with higher land costs residents were paid at around $12,000 each, still $5,000 less than the actual values of their homes. *Ibid*.

disadvantage such areas and, consequently, people of color, without explicitly considering racial factors. Today, such policies, which produce racist outcomes in the absence of overt racist intent, are more politically and legally viable than openly racist policies like those codified by the FHA in 1936, and they are perpetuated by persisting racial segregation.

Such policies contribute to negative outcomes in health, wealth, and freedom for segregated communities of color in California and across the country. There are many stark examples of this process in practice today. Segregated non-white communities have less access to green space and public parks compared to white communities, which causes residents to face increased levels of pollution, extreme heat, and worsened physical and mental health.[55] Segregated non-white communities are targeted with a higher level of police presence and arrest rates than white communities, which leads to the drastic overrepresentation of people of color in the California and U.S. carceral system.[56] Schools in segregated non-white areas receive significantly less funding than predominantly white schools, which contributes to worse educational outcomes for youth of color and limits their future career opportunities.[57] A more integrated society would render such racially discriminatory policies tactically and politically infeasible.

The demographic statistics of current residents in formerly-redlined areas highlight the effectiveness of federal housing policy from the 1930s-1960s in enforcing and perpetuating racial segregation in residential areas, which continues to strongly influence the concentration of non-white racial groups in these areas today. According to a 2020 segregation index built by researchers at UC Berkeley, 73% of census tracts in formerly redlined areas in California exhibit high levels of segregation among people of color, while 93% of census tracts in formerly A-rated areas are characterized by heavy or moderate segregation among white residents.[58] However, it is crucial to further analyze and isolate the relationships between the histories of redlining and highway development and their impact on contemporary outcomes of racial segregation. This examination will help to understand whether the federal government's strategies to enforce segregation in the mid-20th century continue to influence current discriminatory practices. Models 1 and 2 provide data-based evidence of the magnitude and significance of these relationships and the many nuanced factors still driving racial segregation in California today.

55 Lathan, Nadia. "50 years after being outlawed, redlining still drives neighborhood health inequities." University of California, Berkeley Institute of Public Health. Accessed September 28, 2023.; Hsu, Angel, Glenn Sheriff, Tirthankar Chakraborty, and Diego Manya. 2021. "Disproportionate Exposure to Urban Heat Island Intensity across Major US Cities." Nature Communications 12 (1): 2721–11.

56 Public Policy Institute of California. "Racial Disparities in California Arrests." PPIC. October 2019.

57 Fuller, Bruce, Yoonjeon Kim, Claudia Galindo, Shruti Bathia, Margaret Bridges, Greg J. Duncan, and Isabel García Valdivia. 2019. "Worsening School Segregation for Latino Children?" Educational Researcher 48 (7): 407–20.

58 See Appendix 3.5

Model 1 & 2 Results:

Model 1

Non-White Population (%)

	Coefficient:	Std. Error:
Redlined	12.101 ***	1.2
Highway Proximity	1.145 ***	0.198
Green	-28.027 ***	2.13

$R^2 = 0.166$ $df = 2023$

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

Model 2

Non-White Population (%)

	Coefficient:	Std. Error:
Redlined	18.558 ***	3
Highway Proximity	1.396 ***	0.225
Redlined x Highway Proximity	-1.109	0.473
Green	-28.002 ***	2.13

$R^2 = 0.168$ $df = 2022$

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

There are many significant correlations between redlining, highway development, and segregation. Because the interaction term in Model 2 is insignificant, the relationships predicted by Model 1 are the most important to analyze. The model associates census tracts in formerly redlined areas with a non-white population 12.1% greater than their city's average. Conversely, census tracts in formerly A-rated are associated with a 28% smaller non-white population. In addition to this relationship with HOLC risk classifications, a census tract scoring 10/10 on the highway proximity index is correlated with a 5.73% greater non-white population than a census tract scoring 5/10.

In comparing these relationships in urban and rural areas, the relationship between highway proximity and segregation is significantly stronger in rural areas than in urban areas. A five-point increase in the highway proximity index is associated with an 11% increase in non-white population in rural census tracts, compared to just a 3.8% increase in urban census tracts. This disparity is inverted when comparing Stockton and Los Angeles, however. The same increase in highway proximity in Los Angeles is associated with a 7.35% increase in the non-white population, while it is linked to a 3.7% increase in Stockton. This is likely explained by Stockton's unique history of displacement by highway construction as well as the rebuilding of more expensive housing near highways in its urban renewal projects that relocated some non-white residents. These differences in urban versus rural areas and Los Angeles versus Stockton are both statistically significant at a 95% confidence level.[59]

In considering the implications of these model results, it is critical to note that, at 99.9% confidence, the margin by which a select census tract in California's eight redlined cities could deviate from its city's overall percentage of non-white population due to random chance is at most +/- 2.41%. Given that margin, these relationships all indicate links to high levels of segregation throughout California.[60]

59 See Appendix 3.7.

60 See Appendix 3.6.

Particulate Matter 2.5 Pollution

PM2.5 levels refer to the concentration in the air of particulate matter between 0.1 and 2.5 micrometers. Much of the PM2.5 in the air is naturally produced from environmental sources such as the interaction of wind with dust, sea salt, and soil particles. But, human activities like traffic exhaust, fossil fuel burning, and construction have been adding unhealthy amounts of PM2.5 to the air for decades.[61] Traffic exhaust and traffic density, in particular, are leading contributors to elevated PM2.5 levels in cities across California, with specific nexuses of PM2.5 near busy roads and highways.[62] The latest guidelines from the World Health Organization identify an annual average of 5 µg/m3 as a healthy standard of average human exposure to PM2.5,[63] [64] but the average concentration of PM2.5 across California in the latest data collected by the state was as high as 10.18 µg/m3. In Los Angeles, in particular, the median census tract has an annual average concentration of 11.88 µg/m3, which ranks in the 99th percentile for cities nationwide.[65] [66] Stockton, which has an annual average concentration of 11.11 µg/m3, ranks in the 91st percentile nationally.[67]

These staggering totals are cause for concern due to the serious health risks associated with high levels of PM2.5 exposure. These particles can trigger reactionary inflammation in the lungs when inhaled, which is correlated with severe health issues such as low birth rate, heart disease, stroke, lung cancer, and premature death generally.[68] Consistently high PM2.5 exposure is also heavily correlated with higher prevalence and more severe episodes of asthma and can target the developing lungs in unborn fetuses and young children to devastating effect.[69] From a public policy perspective, an im portant finding about the health risks associated with PM2.5 is that the relationship between PM2.5 levels and life expectancy is not linear. The closer initial PM2.5 levels are to zero, the effect of a change in PM2.5 levels on health outcomes will be greater,[70] suggesting that interventions in areas with heavier concentrations would need to deliver major reductions in PM2.5 to improve community health.

61 Environmental Protection Agency, "Particulate Matter Pollution," EPA Website, Accessed January 21, 2024.

62 Chen Y, Gu P, Schulte N, Zhou X, Mara S, Croes BE, Herner JD, Vijayan A. A new mobile monitoring approach to characterize community-scale air pollution patterns and identify local high pollution zones, Atmospheric Environment, Volume 272, 2022. **Link**.

63 World Health Organization, "2021 Global Air Quality Guidelines," Accessed January 24, 2024.

64 California Air Resources Board, "Inhalable Particulate Matter and Health (PM2.5 and PM10)," CARB Website, Accessed February 2, 2024

65 California Office of Environmental Health and Hazard Assessment, CalEnviroScreen 4.0 Online Database, accessed Winter, 2024.

66 Environmental Defense Fund, *U.S. Climate Vulnerability Index*, accessed February 2, 2024.

67 *Ibid*.

68 Correia, A. W., Pope, C. A. III, Dockery, D. W., Wang, Y., Ezzati, M., & Dominici, F. "Effect of air pollution control on life expectancy in the United States: an analysis of 545 U.S. counties for the period from 2000 to 2007." Epidemiology (Cambridge, Mass.) 24, no. 1 (2013): 23–31. **Link**.

69 Xing, Y. F., Xu, Y. H., Shi, M. H., & Lian, Y. X. "The impact of PM2.5 on the human respiratory system." Journal of Thoracic Disease 8, no. 1 (2016): E69–E74. **Link**.

70 Colin D Mathers, Dejan Loncar, "Projections of global mortality and burden of disease from 2002 to 2030," The Lancet 369, no. 9573 (2007): 243-250, accessed February 6, 2024

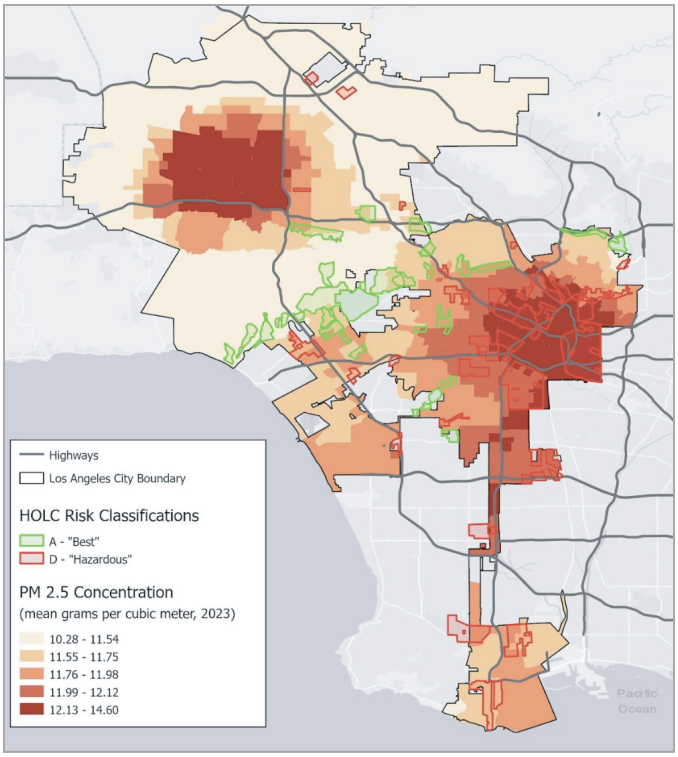


Figure 15: Map of PM2.5 pollution concentration levels in modern-day Los Angeles, CA, overlaid with 1939 HOLC risk classifications for A and D-rated areas and highway routes.

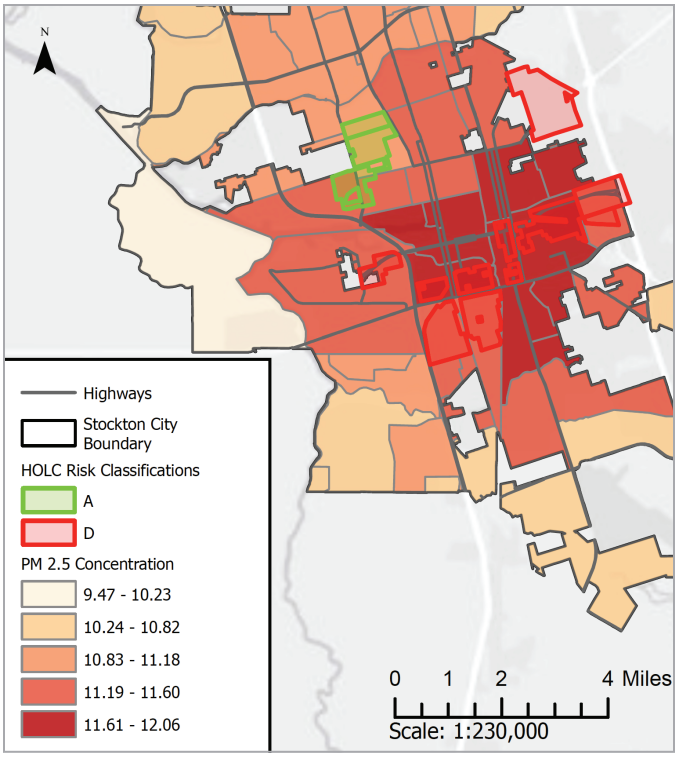


Figure 16: Map of PM2.5 pollution concentration levels in Stockton, CA (2021) overlaid with 1939 HOLC risk classifications for A and D-rated areas and highway routes.

The past tenants of redlining that incentivized authorities and city planners to concentrate industrial and highway development in redlined areas have had the lasting legacy of disproportionately burdening those same predominantly non-white areas with disproportionate PM2.5 pollution today. Nationally, 55% of formerly redlined neighborhoods face PM2.5 levels significantly above the mean in their cities, while 68% of A-rated areas experience levels significantly below their city-level mean.[71] In California, the mean concentration of PM2.5 in D-rated areas is greater than the citywide mean in all eight formerly redlined cities.[72] Figures 15 and 16 spatially illustrate this correlation between past redlining and current PM2.5 pollution in Los Angeles and Stockton, and further reinforce the connection between PM2.5, the proximity of highways, and former HOLC ratings.

This disparity in PM2.5 pollution burden in the state is linked to disparities in the health outcomes connected to PM2.5 exposure. For example, residents of formerly redlined areas in California experience a rate of asthma-induced emergency room visits connected to elevated PM2.5 exposure that is 240% higher than residents of formerly A-rated areas.[73]

71 Lane, HM., Morello-Frosch, R., Marshall, JD., Apte JS. Historical Redlining is Associated with Present-Day Air Pollution Disparities in U.S. Cities. Environ. Sci. Technol. Lett. 2022, 9, 4, 345–350. Link.

72 See Appendix 3.8.

73 Nardone A, Casey JA, Morello-Frosch R, Mujahid M, Balmes JR, Thakur N. Associations between historical residential redlining and current age-adjusted rates of emergency department visits due to asthma across eight cities in California: an ecological study. Lancet Planet Health. 2020 Jan;4(1):e24-e31.

Existing research has established correlations between PM2.5 pollution burdens and redlined areas and between PM2.5 pollution burdens and highway proximity. However, it is critical to parse the specific connections between the intertwined history of redlining and highway development and present-day PM2.5 levels. Models 3 and 4 help isolate the significant effects of highway development and redlining on PM2.5 concentration, as well as study the interaction between all three variables.

Model 3 & 4 Results:

Model 3

	PM 2.5 levels (g/m^3)	
	Coefficient:	Std. Error:
Redlined	.176 ***	.0271
Highway Proximity	.0337 ***	.00444
Green	.0092	.0481
Population Density	.000006 ***	.0889e-5
	$R^2 = 0.09$	$df = 2028$

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

Model 4

	PM 2.5 levels (g/m^3)	
	Coefficient:	Std. Error:
Redlined	.0492	.0676
Highway Proximity	.0288 ***	.00504
Green	.0089	.048
Redlined x Highway Proximity	.0217 *	.0106
Population Density	.000006 ***	.0889e-5
	$R^2 = 0.09$	$df = 2027$

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

The results of Model 3 predict significant baseline relationships between both redlining and PM2.5 levels and highway proximity and PM2.5 levels. The previous redlining of a census tract is associated with a .175 µg/m^3 increase in annual average PM2.5 today, while a tract at the high end of the highway proximity index is correlated with a .337 µg/m^3 increase compared to an identical tract at the low end. Additionally, urban areas and Los Angeles have a statistically significant increase in PM2.5 levels associated with highway proximity when compared to rural areas and Stockton, respectively.[74]

However, the interaction between redlining, highway proximity, and PM2.5 concentration in Model 4 illuminates the impact on communities affected by both these variables, as is the case for many California communities today. The interaction suggests that increases in PM2.5 exposure associated with increased highway proximity are much stronger in formerly redlined communities than in non-redlined areas (.505 µg/m^3 compared to .337 µg/m^3 predicted by Model 3). However, Model 4 also predicts a weaker direct relationship between redlining and PM2.5 when an interaction term is included. This suggests that much of the positive correlation expressed in Model 3 can be attributed to this interaction with highway proximity, rather than past redlining in isolation.

This association with greater PM2.5 levels for the interaction between highway proximity and former redlining is likely produced by other factors that are positively correlated with all three variables. For example, industrial development that produces elevated PM2.5

74 See Appendix 3.7.

could have also been disproportionately concentrated in redlined areas and areas near highways. Additionally, the lack of open green spaces in redlined communities may be particularly prevalent in highway-adjacent areas, exacerbating residents' exposure to PM2.5. Further research that incorporates data on these new variables would be necessary to provide more concrete support for these claims.

It is important to frame these predicted relationships within the context of established correlations between PM2.5 levels and different health impacts. The strongest relationship the models predict is that past redlining and maximum highway proximity in a California community is linked to an increased PM2.5 burden of .505 μg/m^3. Existing research links that difference with just a 0.1% increase in the prevalence of respiratory diseases, a 0.25% increase in overall mortality by 0.25%, and an eight-day decrease in life expectancy, amongst other health impacts.[75] There are 1.28 million people in California who live in formerly-redlined census tracts that score above halfway on the highway proximity scale, meaning this intersected history can be linked to about 1,280 respiratory diseases and 3,200 causes of death annually in this disproportionately non-white population statewide.

Further important context for examining this problem of PM2.5 burdens in a policy context is that PM2.5 particles are widely dispersed in the environment. Although sources of pollution might predominate near certain types of census tracts, the airborne particles are not contained within a census tract-sized area. In all eight of California's formerly redlined cities, the average difference between a census tract in the 25th percentile of PM2.5 concentration and a census tract in the 75th percentile was just 0.48 μg/m^3. This relative uniformity within cities at the census tract level stands in contrast to other harmful pollutants like diesel particulate matter, which remains more concentrated in the areas where it is produced.[76] Despite the variable's significant negative correlation with highway proximity, the positive relationship predicted by both models for formerly A-rated tracts emphasizes the dispersed nature of PM2.5.

Overall, evidence shows California's intersecting history of redlining and highway development has placed a disproportionate burden of PM2.5 pollution on communities of color that still overwhelmingly inhabit formerly redlined areas and areas near highways. This burden is especially amplified in communities that fit both of these descriptions. While the magnitude of increased PM2.5 pollution in such communities is relatively small compared to other communities within the same city, it still produces measurable negative impacts on health outcomes that target non-white Californians.

75 Xing, Y. F., Xu, Y. H., Shi, M. H., & Lian, Y. X., *supra note* 68. Correia, A. W., Pope, C. A. III, Dockery, D. W., Wang, Y., Ezzati, M., & Dominici, F. *supra note* 79.

76 California Air Resources Board, "Overview of Diesel Exhaust and Health," California Air Resources Board website, accessed March 6, 2024.

4

POLICY OPTIONS

CA Department of Water Resources

Traveljunction / Flickr

4. POLICY OPTIONS

4.1. Chapter Overview

This chapter reviews the current policy context relevant to addressing the historical injustices of redlining and highway development in California. This review identifies four policy approaches for achieving this goal and advancing racial and environmental justice and concludes by introducing a set of potential state-level policies for further evaluation.

4.2. Policy Context

Institutions and actors across all levels of government are responsible for the persistence of racist legacies of redlining and highway infrastructure in California. As part of its mission, OEHHA has a vested interest in exploring options for State agencies to address the impacts of these legacies. In addition to OEHHA, other relevant State agencies mentioned include the California State Transportation Agency (CalSTA), which houses CalTrans, tasked with managing all highways and interstate highways within California; CARB, responsible for overseeing air pollution for the State; and the California Transportation Commission (CTC), entrusted with approving state transportation funding.[77]

77 California Department of Transportation, "About Caltrans," accessed April 5, 2024, **Link**.; California Air Resources Board, "About ARB," accessed April 5, 2024, **Link**.; California Transportation Commission, "Home," accessed April 6, 2024, **Link**.; California State Transportation Agency, accessed April 8, 2024, **Link**.

Key Challenges

While actors in California have taken strides to address the adverse effects of highway development and redlining while promoting equity and environmental justice, there are many remaining obstacles. The three most prominent challenges include:

Dependence on Highway-Based Transportation Infrastructure

The majority of Californians rely on car-based transportation, given the State's 248 highways, more than 27 million licensed drivers, and 36 million vehicles.[78] Highways are permanent transportation infrastructure and the transition away from highway dependence requires substantial investments of both time and money. However, decision-makers continue to invest in highway-based transportation infrastructure despite opposition from Tribal Nations and other communities.[79] Even justice-oriented solutions like freeway caps (building green space on top of freeways) reinforce highway dependence; despite their benefits to neighborhood connection and pollution reduction, they have been weaponized to counter efforts to decommission highways.[80] Additionally, current and future freeway cap projects around the country do not adequately prioritize communities of color.[81]

Despite the magnitude of the challenge, grassroots movements have demonstrated that it is possible to stop freeway expansions and remove stretches of freeways altogether. After years of fierce community opposition, activists successfully blocked a $6-billion plan to widen the 710 Freeway, which would have uprooted hundreds of Black and Latine families.[82] In San Francisco, the notorious Embarcadero Freeway was removed in 1991, and removal is currently being considered for the I-980 freeway in Oakland.[83]

Political Resistance to Investing in Reparations for People of Color

The California Reparations Report in 2023 proposed a powerful set of reparative policy measures to seek justice for past harms against Black Californians, including a detailed

78 Statista. "Total Number of U.S. Licensed Drivers by State." Accessed April 8, 2024, **Link**.; California Department of Transportation, 2022 Caltrans Facts, accessed April 8, 2024, **Link**.

79 For an example of California tribes opposing transportation infrastructure, see: ABC7 News, "Native American Tribes Protest Willits Bypass," accessed April 5, 2024, **Link**.

80 Houston, Douglas, and Michelle E. Zuñiga. "Put a park on it: How freeway caps are reconnecting and greening divided cities." *Cities* 85 (2019): 98-109. Accessed January 2022. **Link**.

81 People of color are only 1.1 more likely to be within 0.5 miles to a freeway cap than people of color throughout the entire region. *Ibid.*

82 Rong-Gong Lin II (Uranga), "710 Freeway expansion dropped after decades of planning, marking a milestone for L.A.," Los Angeles Times, March 15, 2022, **Link**.; We use the term "Latine" as a gender-neutral variation of the words Latino/a/@ and Hispanic.

83 Julian Mark, "'Sky's the limit': Caltrans is getting serious about replacing I-980," The Oaklandside, October 30, 2023, **Link**.; KRON4 News, "Why Was San Francisco's Waterfront a Freeway?" accessed April 5, 2024, **Link**.; California Department of Transportation (Caltrans), "Vision 980," accessed April 5, 2024, **Link**.; There have also been moves to block freeway expansions in areas with high levels of pollution and poverty altogether, see Streetsblog California, "No Freeway Expansion Bill Dies in Senate Committee," accessed April 5, 2024, **Link**.; California Legislature, "Analysis of Assembly Bill 1778 (2021-2022)," accessed April 5, 2024, **Link**.

plan to address redlining and highway development.[84] However, discussions leading up to and following the publication of the report revealed fear, prejudice, and misunderstanding around the feasibility and necessity of reparations in California.[85] Furthermore, Title VI of the Civil Rights Act continues to be used as a legal tool to challenge policies or programs aimed at supporting communities of color.[86] This challenge with California's multi-billion dollar budget shortfall for 2022-2025, which is likely to impact decision-makers' ability and willingness to invest in new programs and fully fund current programs.[87]

Lack of Political and Economic Influence of Impacted Communities

Throughout California's history, many policies, including redlining, have limited the political and economic influence of non-white populations. Beyond being segregated into areas with the least amount of resources and the highest pollution levels, legal restrictions have prevented minority groups from voting or holding office, while labor exploitation extracted wealth from these communities into white-dominated areas.[88] The state legislature has failed to ensure that infrastructure investments adequately target these most vulnerable communities. For example, Assembly Bill 2419 (2022) failed to advance beyond committee. The bill mandated that "a minimum of 40 percent of federal infrastructure funds coming to California from the Bipartisan Infrastructure Law prioritize communities of color that have been overlooked or harmed by past infrastructure choices."[89] Federal legislators have also failed to funnel investment into impacted communities. For instance, the U.S. Investing in Opportunity Act of 2017 established tax incentives for investors in designated "Opportunity Zones," but research suggests that these zones do not lift low-income communities out of poverty and instead exacerbate wealth inequality, displacement, and gentrification.[90] This has systematically diminished the capacity of non-white Californians to influence decision-making processes or hold direct power over decisions themselves, thus presenting an obstacle to passing policies that specifically benefit these communities at the expense of wealthy ones.

84 California Department of Justice, "AB 3121 Task Force Report," accessed April 6, 2024, Link.; Similar conversations surround a 2024 reparations bill in California, see New York Times, "Chavez Ravine Reparations for Dodger Stadium," March 26, 2024, accessed April 6, 2024, Link.

85 "Reparations in California: What They Are and What's Happening," CalMatters, accessed April 6, 2024, **Link**.

86 The US EPA has published guidance on how to navigate Title VI and Environmental Justice programs, see: U.S. Environmental Protection Agency, "Title VI and Environmental Justice," accessed April 6, 2024, **Link**. But, legal challenges still arise, see a 2010 example here: Federal Transit Administration, *BART Title VI Final Report* (Washington, D.C.: U.S. Department of Transportation, April 16, 2010), accessed April 5, 2024, Link.

87 "Q&A: What Does the Budget Shortfall Mean for California?," California Budget and Policy Center, accessed April 5, 2024, **Link**.

88 Shaffer, Ralph E. "California Reluctantly Implements the Fifteenth Amendment: White Californians Respond to Black Suffrage, March - June, 1870." Presentation at Cal Poly Pomona, 2020.

89 California Budget & Policy Center, "Q&A: What Does the Budget Shortfall Mean for California?" (accessed April 5, 2024), **Link**.

90 Opportunity Zones are tools aimed at assisting low-income, economically distressed communities. Researchers find that this policy does not have its intended effect. Gabriel Zucman and Emmanuel Saez, "The False Promise of Opportunity Zones," Boston Review, accessed April 5, 2024, **Link**.; Urban Institute, Early Assessment of Opportunity Zones for Equitable Development Projects (Washington, D.C.: Urban Institute, n.d.), accessed April 5, 2024, **Link**.

Key Opportunities

The climate crisis and justice-oriented movements have propelled significant opportunities to implement comprehensive reforms aimed at addressing the impacts of redlining and highway development.

Initiatives Beyond California

The federal government has enacted several pieces of legislation and programs to offer funds for green investment and combating climate change. These initiatives could be used to address the environmental impacts of highway development on redlined communities by protecting communities from pollution and transitioning away from highways. For instance, the Inflation Reduction Act of 2022 emphasizes clean energy economies and established targeted incentives for investing in low-income communities, particularly those disproportionately affected by pollution. Through incentivizing investment in underserved communities, including those affected by redlining, this bill could improve environmental conditions in redlined communities.[91] The White House also announced the Justice40 Initiative in 2021, which directs 40% of benefits from billion-dollar federal environmental investments towards "disadvantaged communities."[92] It further created the Climate and Economic Justice Screening tool to help administer Justice40 funding. However, it's worth noting that Justice40 funding may not effectively mitigate racial and ethnic disparities, as the tool does not include race or ethnicity as a factor.[93]

Programs explicitly targeting the impacts of redlining are gaining significance across the country. The U.S. Department of Justice began a Combating Redlining Initiative in 2021 to target racist practices in the banking sector. The initiative has secured millions of dollars by winning settlement agreements with banks and mortgage lenders, including in Los Angeles.[94] Furthermore, some state and local initiatives have offered reparations to non-white citizens through down-payment assistance. Washington was the first state to approve a program of this nature and is set to begin implementation in July 2024. Local governments in redlined cities across the U.S. have also begun exploring similar initiatives.

California State Initiatives

California is adopting and amending several new regulatory tools that have the potential to address the impacts of highway development on redlined communities. The Transportation Development Act, amended in 2023, could impact funding for equity

91 White House, *Inflation Reduction Act Guidebook* (Washington, D.C.: White House, 2022), accessed April 5, 2024, **Link**.

92 Delger Erdenesanaa, "Signature Biden Program Won't Fix Racial Gap in Air Quality, Study Suggests," The New York Times, July 20, 2023, sec. Climate, **Link**.

93 Yuzhou Wang et al., "Air Quality Policy Should Quantify Effects on Disparities," *Science* 381, no. 6655 (2023): 272–74, **Link**.

94 U.S. Department of Justice, "Justice Department Reaches Significant Milestone in Combating Redlining Initiative," accessed April 5, 2024, **Link**.

in regional transportation planning.[95] California has been at the forefront of adopting indirect source rules (ISRs) under the Clean Air Act. ISRs target and regulate emissions that *indirectly* come from pollution sites (like vehicle emissions from trucks that deliver goods to and from the facility). In 2021, The South Coast Air Quality Management District enacted an ISR to regulate indirect warehouse emissions, which may soon become federally enforceable.[96] CARB has also considered roadside vegetative barriers as a strategy to combat the impacts of air pollution from freeways.[97] In 2013, CalEPA created its Environmental Justice Task Force to coordinate the compliance and enforcement work of the agency in "areas of California . . . burdened by multiple sources of pollution and are disproportionately vulnerable to its effects," including Stockton and Los Angeles.[98] The Task Force has demonstrated early success.

The Community Air Protection Program is a seminal program established in 2017 to protect communities disproportionately impacted by air pollution.[99] An example of efforts within the program is a locally driven study in Fresno to reroute trucks out of overburdened residential areas.[100] The Transformative Climate Communities program (TCC), established in 2016, seeks to fight redlining and climate change by awarding grants for developing and implementing neighborhood-level plans that reduce greenhouse gas emissions and provide multiple benefits.[101] TCC puts frontline communities in charge and requires "all projects to develop a collaborative governance structure between local government, community-based organizations, and residents."[102]

State legislation has also created more equitable approaches to local and regional planning. Senate Bill 1000 (2016) officially incorporated environmental justice into local and regional planning, while Senate Bill 375 (2008) established a "bottom-up" approach to these processes.[103] Senate Bill 1137 (2022) mandates a 3,200-foot health and safety buffer zone between new and reworked oil and gas wells and "sensitive land uses" such as schools and hospitals.[104] The establishment of these buffer zones would limit exposure to PM2.5 in

95 California Legislature, "Bill Comparison: Senate Bill 125 (2023-2024 Session)," accessed April 5, 2024, **Link**.; The National Law Review, "Warehouse and Logistics Operations Targeted in Regulatory Push for Indirect Source Rules," accessed April 5, 2024, **Link**.

96 The National Law Review, "Warehouse and Logistics Operations Targeted in Regulatory Push for Indirect Source Rules," accessed April 5, 2024, **Link**.

97 California Air Resources Board, "Strategy Snapshots," accessed April 5, 2024, **Link**.

98 California Environmental Protection Agency (CalEPA), "Environmental Justice Compliance and Enforcement Task Force," accessed April 5, 2024, **Link**.

99 California Legislature, Assembly Bill 617, 2017-2018 Reg. Sess., accessed April 5, 2024, **Link**.; The Program, however, has faced criticism, which prompted improvement efforts. See California Air Resources Board, "About the California Cap-and-Trade Program," accessed April 5, 2024, **Link**.

100 California Air Resources Board, "Community Identified Project Approval Notice: San Joaquin Fresno Truck Study," accessed April 5, 2024, **Link**.

101 UCLA Luskin Center for Innovation, "Transformative Climate Communities," accessed April 5, 2024, **Link**.

102 Greenlining Institute, "Transformative Climate Communities," accessed April 5, 2024, **Link**.

103 California Legislature, Senate Bill 1000, 2015-2016 Reg. Sess., accessed April 5, 2024, **Link**.; California Institute for Local Government (CA ILG), "The Basics of SB 375," accessed April 5, 2024, **Link**.

104 California Legislature, Senate Bill 1137, 2021-2022 Reg. Sess., accessed April 5, 2024, **Link**.

overburdened areas if it survives the oil industry-backed veto referendum on the upcoming ballot.[105] State legislators also formed a Select Committee on Reconnecting Communities in 2023, aiming to "explore ways the state can reconnect neighborhoods that decades ago were torn apart by interstates and highways," and take advantage of the federal funds through the Reconnecting Communities and Neighborhoods Grant Program.[106]

Culture Shift in State Agencies

California State agencies are initiating cultural changes aimed at prioritizing racial equity. A 2022 Executive Order mandates state entities to "embed and institutionalize racial equity strategies across their policies, programs, and initiatives," which has led to the creation of the Racial Equity Commission to support that effort.[107] Some leaders within agencies like CalTrans profess that the agency now places equity and engagement at its core.[108] To reflect this commitment, CalSTA created a Climate Action Plan for Transportation Infrastructure and is in the process of developing a Transportation Equity Index that will help CalTrans prioritize and evaluate plans and projects.[109] But, this comes at a time when CalTrans is facing increased scrutiny from community groups and the federal government over its handling of proposed freeway expansion projects.[110]

Housing Nexus

Exploring the intersection between transit and California's housing crisis holds the potential to capitalize on funding opportunities and create more integrated communities. In response to long-standing housing inequities, California has passed bills to address the consequences of redlining and similar discriminatory practices. Of note are Assembly Bill 1466, which required counties across California to remove any unlawful restrictive covenant language on historical public records, and Assembly Bill 686, which required all

105 California Legislature, "Analysis of Senate Bill 1137 (2021-2022 Session)," accessed April 5, 2024, **Link**.; California Geologic Energy Management Division (CalGEM), NTO 2023-03, accessed April 5, 2024, **Link**.

106 "Reconnecting Communities," CalMatters, February 2023, accessed April 5, 2024, **Link**.; Select Committee on Reconnecting Communities, "Reconnecting Communities: CA Freeways - Past and Present," YouTube video live stream, 2:15:27, Select Committee on Reconnecting Communities, December 8, 2023, **Link**.; "Select Committee on Reconnecting Communities," California State Assembly, accessed April 5, 2024, **Link**.

107 California Office of Planning and Research, "Racial Equity Action Plan," accessed April 6, 2024, **Link**.

108 "Undoing the Past: Lawmakers Seek to Mend California Neighborhoods Sliced by Highways," KQED, February 7, 2024, accessed April 5, 2024, **Link**.; Select Committee on Reconnecting Communities, "Reconnecting Communities: CA Freeways - Past and Present," YouTube video live stream, 2:15:27, Select Committee on Reconnecting Communities, December 8, 2023, **Link**.

109 CalTrans also outlines this commitment in its guidance documents, including its Equity statement, the California Transportation Plan 2050, and the CalTrans 2020-2024 Strategic Plan. California Department of Transportation (Caltrans), "Caltrans Equity, Quality, and Inclusion (EQI) Program," accessed April 5, 2024, **Link**.

110 For an example, see details on the Highway 99 Project at "Highway 99 Fresno," Fresno Land, January 12, 2024, accessed April 5, 2024, **Link**.; "Showdown on the I-15," Politico California Climate Newsletter, January 25, 2024, accessed April 6, 2024, **Link**.

public agencies to affirmatively further fair housing in California.[111]Additionally, leadership changes in both houses of the state legislature suggest future laws will be more pro-housing overall.[112]

In anticipation of the 2028 Olympics, Los Angeles is implementing infrastructure projects to enhance its transportation capacity. If leveraged well, these projects could benefit formerly redlined communities. The city and local transit organizations are relying on partnerships with academics and private industry to complete transportation projects quickly and sustainably such as TRACtion.[113] Additionally, the Los Angeles CleanTech Incubator established the Transportation Electrification Partnership with the express goal of "accelerating transportation electrification and zero emissions goods movement throughout the Los Angeles region in advance of the 2028 Olympic and Paralympic Games by pursuing bold targets, pilots, initiatives, and policies that are equity-driven, create quality jobs, and grow the economy."[114]

4.3. Policy Options

Based on a review of the context surrounding the legacies of redlining and highway development in California, the following four policy approaches have been identified and developed alongside 13 distinct policy options for further evaluation.[115] We use these four approaches to better organize and categorize our 13 policy options.

Focus Explicitly on Race and Ethnicity

The review suggests that policies addressing the lasting impacts of redlining and highway development should codify an explicit focus on communities of color that were directly affected by these discriminatory decisions into law. We have identified the following as potential policy options within this approach:

1. **40% of Federal Funds into Communities of Color:** In line with the Justice40 Initiative, California State agencies should ensure at least 40% of funds from major federal sources are invested into communities of color to advance efforts in environmental

111 Los Angeles County Registrar-Recorder/County Clerk, "Restrictive Covenant Modifications," accessed April 5, 2024, **Link**.; "L.A. County Will Remove Racist Restrictive Covenant Language from Millions of Documents," Los Angeles Times, February 6, 2024, accessed April 5, 2024, **Link**.; "Restrictive Covenant Modification Implementation Plan," Los Angeles County Registrar-Recorder/County Clerk (RR/CC), accessed April 5, 2024, **Link**.; California Department of Housing and Community Development (HCD), "Affirmatively Furthering Fair Housing," accessed April 5, 2024, **Link**.

112 CalMatters, "California Legislature Makes Unprecedented Investments in Housing," November 14, 2023, accessed April 5, 2024, **Link**. ; "Oil's No Good, Very Bad Week," Politico California Climate newsletter, February 2, 2024, accessed April 5, 2024, **Link**.; "Mike McGuire Takes Reins of California Senate," CalMatters, February 5, 2024, accessed April 5, 2024, **Link**.

113 UCLA Sustainable LA Grand Challenge, "Traction: Transportation," accessed April 5, 2024, **Link**.

114 Los Angeles Cleantech Incubator, "Transportation," accessed April 5, 2024, **Link**.

115 Due to space and time constraints, we chose to only evaluate 13 policy options for this report. For our full list of policy options, including context on Tribal Nations, see Appendix 4.2 and 4.3.

justice.[116] All funds should be tracked and publicly posted to help ensure funds are being allocated as such. This includes 1) CalEPA using Inflation Reduction Act funds and 2) CalTrans using Department of Transportation Re-Connecting Communities Plan funds to redress harms and address environmental hazards.

2. **Statewide WAIRE:** CARB should use the South Coast Air Quality Management District's (AQMD) Warehouse Indirect Source Rule (WAIRE) as a statewide model to manage emissions and pollution from power plants, waste sites, ports, refineries, and vehicles. Fines collected from violators could be utilized to fund compliance activities and be directly redistributed to formerly redlined communities. As an incentive, fines collected could also go back to facilities that meet the required standards in formerly redlined communities.
3. **Homeownership Funds for Communities of Color:** The California Department of Housing & Community Development (HCD) should provide hyper-local grants or contracts that focus on homeownership assistance to communities of color and formerly redlined communities. This will help address housing discrimination and promote the racial integration of neighborhoods throughout California.

4. **Cash Reparations for Black Californians:** Budget allocations for state agencies should follow the reparations Task Force recommendations to provide reparations payments to descendants of enslaved people. Because the U.S. Census does not currently identify the number of such descendants in the state, the report uses the number of census respondents who identified as Black or African American alone as a rough estimate.

Increase and Improve Community Empowerment and Decision-Making Authority

The literature suggests that although many policies aimed at addressing redlining and highway development have environmental justice principles and community empowerment provisions, in reality, these principles have often been overridden, thereby preventing communities from fully participating or leading projects and decisions impacting them. This approach gives historically redlined communities more power to bring about just solutions that are rooted in their own community needs. We will examine the following policy options within this approach:

5. **Decision-Making Power for Impacted Communities:** Give the power to formerly redlined communities or communities of color to make decisions on policies related to environmental justice and equity by:
    a. Mandating approval from impacted communities for (1) any new industrial development plans or re-zoning that would increase pollution in formerly

116 CalEnviroscreen can be used to identify these communities, although there are criticisms and shortcomings of the tool. California law defines environmental justice as the "fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws and policies" (Government Code section 65040.12).

redlined areas and (2) the development of the Community Air Monitoring Plans (CAMPs), Community Emissions Reduction Programs (CERPs), and substantive actions by the Air Districts supported by California Air Resources Board (CARB) to significantly reduce emissions.

b. Create substantial and institutionalized avenues for residents of formerly redlined communities to exercise leadership (including serving on boards, commissions, and advisory councils) within programs, grant allocations, and regulatory decision-making processes. These bodies should be allocated a portion of the city budget to pursue initiatives that address the impacts of redlining.

6. **Incentivize Community Involvement:** The state should systematically incentivize community involvement in shaping environmental justice policies and initiatives.

   a. Enhance public notice and scoping meeting requirements under the California Environmental Quality Act (CEQA) for projects that propose the siting and expansion of polluting land uses in overburdened communities.[117]

   b. Increase community involvement in public forums by (1) facilitating CBO participation through accessible government stipends or honorariums and (2) providing childcare, food, and language access services at public meetings to accommodate all income levels and family dynamics. This may require creating carve-out funding or incentives in programs.

   c. Allow agency staff more time and an increased mandate to plan meaningful public opportunities to gather community input and partner with community members on key initiatives.

7. **Flexible Budgets and Timelines:** In line with the Clean Mobility Equity Playbook, "allow more flexibility for programs to manage their own budgets and timelines. Equity programs often require greater resources, capacity, and longer timelines to [achieve] their goals."[118]

Use Zoning and Planning Goals

The literature review suggests that incorporating policies to address the impacts of redlining and highway development by altering zoning and planning goals can facilitate more equitable and inclusive communities. We will examine the following policy options within this approach:

8. **Highway Redesign and Truck Rerouting**: In their 2025 update to the California Transportation Plan (CTP), CalTrans should:

   a. Use AB 617 funding to mandate that local governments develop plans to reroute trucks away from pollution-burdened communities

117 Some strategies include establishing a proportion of the population that has to provide feedback on a project, creating advisory groups, and requiring community members be included in earlier parts of the process.

118 Greenlining Institute, Clean Mobility Equity: A Playbook (Oakland, CA: Greenlining Institute, 2021), accessed April 8, 2024, **Link**.

b. Designate state funds to require Regional Transportation Planning Associations and Metropolitan Planning Organizations to conduct studies into possible freeway re-design projects – such as freeway capping to removal – and grant the CalTrans Racial Equity and Transportation Advisory Committee with ultimate authority to fund the implementation of worthy projects, and

c. Strengthen measures to protect community members from displacement due to transportation development projects.

d. Appoint the Racial Equity and Transportation Advisory Committee established in Recommendation 4.3 of the 2021 CTP as the main liaison for community input on these initiatives and as partners in all plan development and funding decisions.

9. **Segregation Element:** Using data from CalEPA and HCD tools as evidence, the state should require all formerly redlined cities in California to include a specific Segregation Element within their General Plan that addresses current levels of segregation in the city and establishes strategies to promote integration, such as inclusionary zoning or investment in fair housing projects. It should also establish and maintain a public database of integration planning resources and examples, managed by HCD, as well as a standing advisory board of representatives specifically from formerly-redlined communities to advise and participate in the planning process of this element. The public database should be available to all jurisdictions that want to pursue a segregation element in its General Plan, not just the mandated eight cities.

10. **Create 'Overburdened' Pollution Standard:** CalEPA should create a regulatory standard that indexes pollution levels in a community and sets a threshold for what constitutes an overburdened community in California. This standard should further require city plans to establish which communities are overburdened in their Environmental Justice Elements and amend land use policies to prevent further development of high-polluting land uses (highway expansion, industrial development) and promote land uses that relieve pollution (green space development, traffic reduction) in those communities. The state should offer subsidies for jurisdictions that implement these requirements and fines for those that do not.

Make Data More Accessible

The literature suggests that although data is available, it is hard to access and understand, which prevents it from being a useful resource to best pinpoint where and how solutions should be implemented. This approach does not directly reduce the lasting impacts of redlining and highway development, but provides tools for communities to use data to identify inequities and advocate for solutions. We have selected the following policy options within this approach for further evaluation:

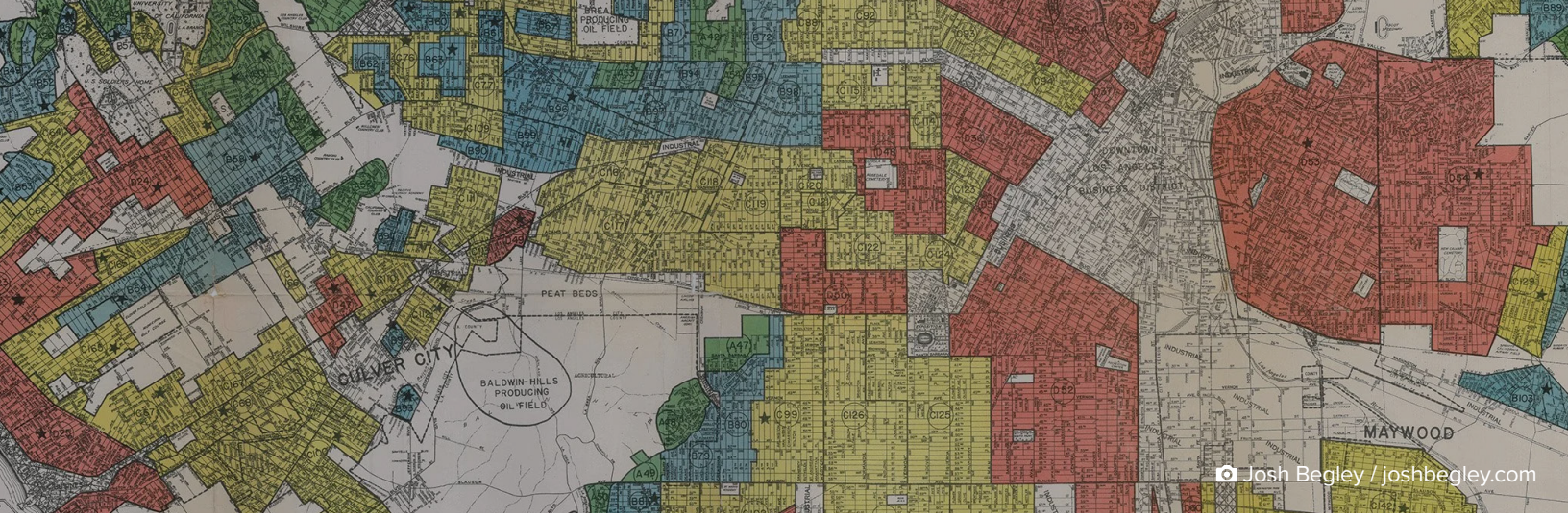
11. **Increase Grant Accessibility:** All state agencies providing grant funding for environmental justice and racial equity programs should increase the level of accessibility and support for potential grant recipients to 1) improve the California

Grants Portal to make programs more accessible through use of plain language and multiple languages 2) provide increased technical assistance for grant applications to relieve the need for grant staff at organizations.

12. **Add Segregation and Redlining Data to CalEnviroscreen:** OEHHA should incorporate the following data into the publicly accessible CalEnviroscreen tool so that communities may use it to understand the connections between past redlining and present environmental injustice and use it as evidence to help advocate to eradicate such injustices:
    a. Data on segregation levels by census tract from UC Berkeley's Roots of Structural Racism Project. As this data was gathered in 2020, OEHHA should continue to periodically update such data using the latest census tract information and the methods used by UC Berkeley researchers to create this segregation index.
    b. Past HOLC areas, using data from the University of Richmond's Mapping Inequality Project. This data could also be applied at the census tract level to allow users to view the former risk grade of each census tract where applicable.
13. **Expand CalTrans Equity Index Data:** OEHHA and CARB should work with CalTrans to develop an Equity Index with a wider range of data to include UC Berkeley's segregation index, University of Richmond's HOLC Areas, and pollution levels from CES 4.0 to consider pollution in overexposed communities. These efforts should include funding to update, improve, and maintain this data.

5
POLICY EVALUATION

US EPA / Facebook



5. POLICY EVALUATION

5.1. Policy Evaluation Overview

This chapter breaks down the evaluation process of the 13 identified policy options and provides recommendations for which should be implemented by state agencies.

Key Criteria

To evaluate the final list of policy options and provide recommendations, we compiled five key criteria:

- **Environmental justice principles**, particularly those centered around the themes of justice, autonomy, and "policy, politics, and economic processes," and how well the policy adheres to those principles.[119]
- **Address segregation and PM2.5 levels**, which we define as the extent to which these policy options are designed to alleviate the disproportionate socioeconomic and environmental burdens caused by redlining and highway development on impacted communities in California.
- **Socio-political feasibility**, which considers the levels of support for the policy and the relative ease or difficulty of getting it into law.[120]
- **Efficacy**, which we define as the ability of the policy option to produce its intended result. This includes considerations of the financial, social, and administrative costs of the policy.[121]
- **Generalizability,** which we define as the extent to which research findings can be applied to other settings or contexts.

119 Dorceta Taylor, "The Rise of the Environmental Justice Paradigm: Injustice Framing and the Social Construction of Environmental Discourses," American Behavioral Scientist 43 (2000): 508-580, Link.

120 H. Lawford-Smith, "Understanding Political Feasibility," Journal of Political Philosophy 21 (2013): 243-259, Link.

121 Collins Dictionary, s.v. "Efficacy," accessed April 5, 2024, Link.

These criteria were chosen for the policy evaluation because they are project-specific, equity-focused, and policy-oriented. The criteria will target segregation and PM2.5 levels, which are emblematic of broader socio-economic and environmental impacts. Our team and client are interested in advancing equitable solutions, which promote the use of environmental justice principles as key criteria. This decision stems from acknowledging that "environmental justice" is cited and operationalized in current policies and programs in this field. Lastly, political feasibility and efficacy serve as policy-specific metrics that will gauge the function and use of our ultimate recommendations.

Evaluation Criteria Breakdown

To analyze the 13 policy options, we utilized a Criteria Alternatives Matrix (CAM). CAM allows for a systematic and transparent evaluation of different policies across a range of criteria to assess each of their strengths and weaknesses and assign each a composite score to reflect its fit with our policy goals.

Each of the five evaluation criteria was assigned a possible maximum score to weigh its importance to the overall quality of the policy in question. The maximum composite score for any given policy is 100. A composite score above 50 indicates a policy that has benefits that outweigh its flaws and effectively addresses the discriminatory legacies of redlining and highway development in California. To ensure the robustness of our recommendation threshold based on the sensitivity tests we conducted,[122] we applied a margin of error of two points to this threshold, raising the target score for recommendations to 52.

For each of the criteria, our evaluation is guided by a series of sub-questions about the nature of the policy, detailed in Figures 17-21. Together, the sub-questions are designed to cover all the important components of the wider criterion.

Figure 17: Promotion of Environmental Justice Principles sub-questions and points.[123]

Promotion of Environmental Justice Principles	30 total points
Does the policy help enforce the right of communities to be free from ecological destruction?	6 points
Is the policy based on mutual respect and justice for all peoples, free from any form of discrimination or bias?	6 points
Does the policy protect or establish the right of communities to participate as equal partners at every level of decision making (needs assessment, planning, implementation, enforcement, and evaluation)?	6 points
Does the policy protect or promote the right of victims of environmental injustice to receive full compensation and reparations for damages?	6 points
Does the policy help mandate the right to ethical, balanced, and responsible uses of land and renewable resources in the interest of a sustainable planet for humans and other living things?	6 points

122 For more information on our sensitivity tests, see Appendix 5.8.

123 See Appendix 5.1 for further explanations of the sub-questions and weights assigned to them.

Figure 18: Promotion of Environmental Justice Principles sub-questions and points.[124]

Reduction of PM 2.5 Pollution and/or Racial Segregation	30 total points
Does the policy help reduce the burden of PM 2.5 pollution on formerly redlined communities/communities of color in California?	10 points
Does the policy help reduce the high levels of residential racial segregation in California connected to its histories of redlining and highway development?	7 points
Does the policy help address other harms to communities of color that stem from residential racial segregation?	5 points
Does the policy help meaningfully reduce overall levels of PM2.5 pollution levels?	4 points
Does the policy help reduce the burden of related pollutants (diesel particulate matter, PM 10, more) on formerly redlined communities/communities of color in California?	4 points

Figure 19: Socio-Political Feasibility sub-questions and points.[125]

Socio-Political Feasibility	20 total points
How much political support is there for the policy?	3 points
How much political opposition is there to the policy?	3 points if no opposition
Is there a reason to think support for the policy might increase in the future?	2 points
Could the policy be officially adopted without the legislature or a ballot measure?	4 points
What is the level of support for the policy amongst the communities it seeks to support?	4 points
Did communities facing environmental injustice in California participate in developing and advocating for the policy?	4 points

Figure 20: Efficacy sub-questions and points.[126]

Efficacy	14 total points
What are the monetary and social costs of the policy, relative to its designed impacts?	6 points if low
How manageable would it be to implement and administer the policy?	4 points
How long would it take for the policy to begin producing meaningful impacts?	2 points
Are there foreseeable scenarios that would cause the policy to become ineffective or irrelevant in the near future?	2 points if no

Figure 21: Generalizability sub-questions and points.[127]

Generalizability	6 total points
Can the policy be effective across jurisdictions with different socioeconomic, environmental, and cultural characteristics in California?	3 points
Can the policy be an effective model for jurisdictions outside California?	3 points

124 See appendix 5.2 for further explanations of the sub-questions and weights assigned to them.
125 See appendix 5.3 for further explanations of the sub-questions and weights assigned to them.
126 See appendix 5.4 for further explanations of the sub-questions and weights assigned to them.
127 See appendix 5.5 for further explanations of the sub-questions and weights assigned to them.

5.2. Evaluation Results[128]

CAM analysis results for each four policy approaches. Total scores and criteria-specific scores for each approach reflect the mean score of all the proposed policy options within that approach. Figure 22 shows the composite scores of the four different policy approaches, generated by averaging the scores for each individual policy within each approach across the five evaluation criteria. Figures 23-26 show the scores assigned to each individual policy. We discuss the relative strengths and weaknesses of each policy and each wider approach in the next pages.

Legend 1: for Figures 22-26

Total Score Coding:

- Strongly Recommend (>60 points)
- Recommend (56-60 points)
- Tentatively Recommend (53-55 points)
- Neither Recommend nor Reject (49-52 points)
- Tentatively Reject (46-48 points)
- Reject (40-45 points)
- Strongly Reject (<40 points)

Criteria Score Coding:

- # Extreme Strength*
- # Strength*
- # Neither Strength nor Weakness
- # Weakness*
- # Extreme Weakness*

*relative to scores of other policy options
**See Appendix 5.6 for breakdown of ranges for each evaluation criteria

Figure 22: CAM analysis results for each four policy approaches. Total scores and criteria-specific scores for each approach reflect the mean score of all the proposed policy options within that approach.

Policy Approach		Focus Explicitly on Race and Ethnicity	Community Empowerment and Decision-Making	Zoning and Planning Goals	Make Data More Accessible
Criteria	Weight (points out of 100)	Average Score of Policy Approach			
Promotion of environmental justice principles	30	12.75	15	17.2	11.67
Reduction of PM 2.5 pollution and/or racial segregation	30	11.25	10.33	17.3	5.67
Socio-political feasibility	20	13	10.67	13	13.83
Efficacy	14	7.25	6.5	8.7	11.67
Generalizability	6	5	6	4.8	6
TOTAL SCORE	100	**49.25**	**48.5**	**61**	**48.84**

128 See appendix 5.7 for a full matrix of the scores assigned to each of the 13 policies we reviewed for every sub-question within our criteria.

Focus Explicitly on Race and Ethnicity

Figure 23: CAM analysis results for the three proposed policy options within the Race and Ethnicity approach. Refer to Legend 1 for color codes.

Focus Explicitly on Race and Ethnicity		#1: 40% of Federal Funds into Communities of Color	#2: Expanded Statewide Warehouse Indirect Source Rule	#3: Homeownership Grant Fund for Communities of Color	#4: Cash Reparations for Black Californians
Criteria	Weight (points out of 100)	Average Score of Policy Approach			
Promotion of environmental justice principles	30	16	15	**9**	**11**
Reduction of PM 2.5 pollution and/or racial segregation	30	12	**16**	14	**3**
Socio-political feasibility	20	14	14	11	13
Efficacy	14	8	8	8	**5**
Generalizability	6	5	5	4	**6**
TOTAL SCORE	100	**55**	**58**	**46**	**38**

We recommend Options #1 and #2 within this policy approach. Both policies are well-rounded and score above 50 for each criterion. Both do particularly well in promoting environmental justice principles and garnering community support. Moreover, they can be implemented without legislative action and can utilize existing regulations as implementation models, with Option #2 using AQMD's WAIRE program and Option #1 using the Justice40 initiative, respectively. However, widespread adoption may take more time without legislative action. Option #1 has the hurdle of attaining implementation in each California State agency. Even with environmental justice groups' support, the process may take considerable time to implement across agencies and face opposition. Legislative or ballot measures could expedite the process but would necessitate advocacy, campaigning, and grassroots organizing efforts. While Option #2 does not address residential racial segregation, it most effectively reduces PM2.5 pollution and other environmental pollutants in communities of color facing disproportionate environmental burdens, making it a top policy recommendation.

Options #3 and #4 fall short in promoting environmental justice principles compared to other policy options. They also face political opposition and legislative challenges that render them less politically feasible. Option #4, in particular, offers minimal direct reduction of PM2.5 pollution levels or racial segregation; cash reparations, without community empowerment, may not foster the necessary collaboration needed to create systemic change. Option #4 also faces high costs with no direct funding source present, which makes it the lowest-scoring option in the category.

Increase and Improve Community Empowerment and Decision-Making Authority

Figure 24: CAM analysis results for the three proposed policy options within the Community Empowerment approach. Refer to Legend 1 for color codes.

Community Empowerment and Decision-Making		#5: Decision-Making Power for Impacted Communities	#6: Incentivize Community Involvement	#7: Flexible Budgets/ Timelines for Programs
Criteria	Weight (points out of 100)	Average Score of Policy Approach		
Promotion of environmental justice principles	30	18	18	9
Reduction of PM 2.5 pollution and/or racial segregation	30	16	15	0
Socio-political feasibility	20	10.5	10	11.5
Efficacy	14	6.5	6.5	6.5
Generalizability	6	6	6	6
TOTAL SCORE	100	**57**	**55.5**	**33**

We recommend Option #5 and Option #6 within the community empowerment approach. Both options excel in promoting environmental justice principles and reducing the burden of PM2.5 pollution on formerly redlined communities and communities of color. Leveraging existing regulations like the community benefits policies in Option #5 and CEQA in Option #6 effectively addresses environmental justice concerns and fosters community engagement. These options can also be implemented without legislative action, although state involvement helps provide comprehensive frameworks and support to ensure successful implementation. Options #5 and #6 could serve as effective models for jurisdictions outside of California seeking to implement robust environmental review processes and ensure meaningful community involvement in development decisions. The primary challenge for both options is the feasibility of implementing and administering the policies. For Option #5, municipal governments may face resource constraints and compliance issues between developers and the community. For Option #6, the lengthy and costly processes of incentivizing and facilitating community participation on all relevant local issues constitute a major challenge to the efficacy of the policy.

Option #7 would have no significant impact in helping relevant programs reduce pollution burdens and promote integration, even on more flexible timelines, and therefore would not help achieve our central policy goals.

Use Zoning and Planning Goals

Figure 25: CAM analysis results for the three proposed policy options within the Zoning and Planning approach. Refer to Legend 1 for color codes.

Zoning and Planning Policy Options		#8: Highway Redesign and Truck Rerouting	#9: Segregation Element	#10: Create 'Overburdened' Pollution Standard
Criteria	Weight (points out of 100)	Average Score of Policy Approach		
Promotion of environmental justice principles	30	17	16.5	18
Reduction of PM 2.5 pollution and/or racial segregation	30	18	19.5	14.5
Socio-political feasibility	20	14	9.5	15.5
Efficacy	14	4	9.5	12.5
Generalizability	6	5	3.5	6
TOTAL SCORE	100	**58**	**58.5**	**66.5**

We recommend all three of our proposed policy options in this approach. As Figure 22 details, the CAM analysis finds the most utility in using zoning and planning goals to address the ongoing impacts of redlining and highway development in California. The three zoning and planning policies averaged an overall score well above the 52 threshold for recommendation, significantly above any of the other policy approaches that were considered. Furthermore, the approach averaged scores greater than 52 for each evaluation criterion, indicating its widespread effectiveness across all key aspects of policy-making. Zoning and planning policies were especially well-equipped to promote environmental justice principles and address the impacts of racial segregation and PM2.5 pollution burden – the two most important evaluation criteria. The minor weaknesses of this approach include the amount of time it takes for policies to begin producing intended effects and the amount of participation and decision-making authority they afford to impacted communities.

Option #10 scored the best of the 13 options analyzed. This proposal – for CalEPA to prohibit further high-polluting land uses in overburdened communities above a defined pollution threshold – scored 85% of possible points across the feasibility, efficacy, and generalizability criteria. This was due to the unique combination of cost-effectiveness, political support, and community involvement woven into the policy. The model for such pollution-reducing zoning regulations comes from Stockton's General Plan, which was developed with robust community engagement on environmental justice components. The policy also uses data-driven standards to add teeth to the statewide environmental justice planning requirements established by SB 1000, a bill that community-based organizations played a large role in developing back in 2016. Overall, the set of

regulations in Option #10 would instigate meaningful change to disrupt the continuing patterns of over-pollution in formerly redlined communities and would prompt cities to craft innovative solutions alongside communities to reduce the disproportionate pollution burden faced by communities of color moving forward.

Options #8 and #9 should also be adopted by the State. The facilitation of truck rerouting plans and freeway redesign projects like freeway capping in Option #8 promotes increased social and financial mobility for Californians of color alongside its main function of radically improving air quality and reducing pollution in their communities. The policy is also modeled on community-driven initiatives in California, such as Fresno's Truck Reroute Study and proposals for the Park 101 freeway cap in Los Angeles. However, the immense disruption and monetary and time costs associated with freeway reduction and freeway capping are drawbacks to its efficacy.

Option #9 requires formerly redlined cities to implement a segregation element in their general plan. The binding requirements for pro-integration planning solutions provide enough unique opportunities to advance environmental justice and integration to overcome the feasibility and efficacy constraints of having to pass such requirements into law through the legislature. Its eventual implementation, however, could be fraught with local turmoil in cities like San Francisco and Los Angeles, as community leaders from NIMBY groups, as well as from communities of color that fear gentrification and displacement, could resist integration planning initiatives.

Make Data More Accessible

Figure 26: CAM analysis results for the three proposed policy options within the Data Accessibility approach. Refer to Legend 1 for color codes.

Making Data More Accessible Policy Options		#11: Increase Support for EJ and Equity Grant-Seekers	#12: Add Segregation and Redlining Data to CalEnviroscreen	#13: Expand CalTrans Equity Index
Criteria	Weight (points out of 100)	Average Score of Policy Approach		
Promotion of environmental justice principles	30	13	12	10
Reduction of PM 2.5 pollution and/or racial segregation	30	10	5	2
Socio-political feasibility	20	13.5	14	14
Efficacy	14	10	13	12
Generalizability	6	6	6	6
TOTAL SCORE	100	**52.5**	**50**	**44**

We recommend Option #11 in this approach. The overall strength of the policies from this category is that they all are relatively easy to implement, have little costs attached to them, and increase communities' understanding of local issues. This promotes equity and autonomy for communities to use information in support of their collective local interests. Its main weakness is that increased data accessibility does not directly improve PM2.5 pollution or segregation on its own.

Option #11 is the best option from the category because it includes direct help with grant writing for state funds. Grant writing is a niche skill that is a barrier for many grassroots organizations. This policy alleviates that burden and makes state funding more attainable for impacted communities to push forward work that addresses local concerns of environmental and racial justice. The weakness of this policy is that it does not provide increased funding or availability for grants that address PM2.5 pollution or segregation.

Option #12 reached the threshold for recommendation and would supplement the current CalEnviroScreen tool by adding segregation data and outlining historically redlined communities. This is relatively simple to implement because data sources for this already exist and can be combined into CalEnviroScreen to make the tool more robust in its visualization of where pollution is concentrated and the broader factors linked to that pollution. This would be a great tool for advocacy and would also point to where California agencies will need to allocate their resources for true environmental justice. The main weakness of this policy is that it provides no funding or direct action to address the central issues and could have an overall limited reach. Additionally, this option did not pass the margin of error, preventing its recommendation.

Option #13 prioritizes mobility using the CalTrans Equity Index. Although incorporating data on pollution and segregation into this index is important, it may not be as effective in advocating for these issues compared to the CalEnviroScreen.

5.3. Recommendations Summary

In summary, we recommend eight of our proposed policy options for the state to adopt.

Strongly recommend:

- Option #10 (66.5): CalEPA should create a regulatory standard to identify communities overburdened by pollution and require the implementation of land uses in such communities that relieve said pollution burden.
    - Option #10 is cost-effective and has strong political support and community involvement components.

Further recommend:

- Option #9 (58.5): Institute a State requirement for formerly redlined cities to include a Segregation Element within their General Plan that establishes strategies to promote integration.
    - Option #9's binding requirements provide enough unique opportunities to advance environmental justice and integration.

- Option #2 (58): CARB should use the South Coast AQMD's Warehouse Indirect Source Rule as a statewide model to manage emissions and pollution from all high-polluting industrial sources.
    - Option #2 effectively reduces PM2.5 pollution and other environmental pollutants in communities of color facing disproportionate environmental burdens.

- Option #8 (58): CalTrans should prioritize and fund truck rerouting and highway redesign plans across the state in their 2025 CTP update.
    - Option #8 is especially well-equipped to promote environmental justice principles and address the impacts of racial segregation and PM2.5 pollution burden.

- Option #5 (57): The state should entrust decision-making power to formerly redlined communities or communities of color over policies concerning environmental justice and equity.
    - Option #5 excels in promoting environmental justice principles and reducing the burden of PM2.5 pollution on formerly redlined communities and communities of color.

Tentatively recommend:

- Option #6 (55.5): State agencies should systematically incentivize community participation and input around environmental justice policies and initiatives.
    - Option #6 effectively addresses environmental justice concerns and fosters community engagement.
- Option #1 (55): State agencies should ensure at least 40% of funds from federal environmental and transportation programs are invested in communities of color.
    - Option #1 promotes environmental justice principles and garners community support.
- Option #11 (52.5): All state agencies providing grant funding for environmental justice and racial equity programs should increase the level of accessibility and support for potential grant recipients.
    - Option #11 is relatively easy to implement, has low costs, and increases community understanding of local issues.

Relying on the status quo of policies is not enough to dismantle the systems leading to racial segregation and disproportionate pollution burdens for non-white communities around California. The unequal outcomes in health, income, safety, and more that stem from these systemic inequalities throughout the state are only getting worse.[129] Adopting this set of policy recommendations, especially those that score above 55 points in the CAM analysis, is an urgently necessary set of actions that would help address gaps in statewide policy related to the environmental justice needs of these communities.

129 "Segregation Is Getting Worse in the U.S. The Bay Area Is No Exception," KQED, accessed April 5, 2024, **Link**.

5.4. Conclusion

This report examined California's intertwined history of discriminatory redlining and highway development, illuminating troubling connections between that history and present-day deficits in environmental and socioeconomic outcomes for non-white Californians. In this examination, we specifically focused on the disparities in PM2.5 pollution exposure between redlined and non-redlined communities today, as well as the current levels of residential racial segregation that correspond to past HOLC risk grades. Employing a combination of existing research and original spatial and data analysis, we uncovered significant findings. We demonstrated a staggering association between previously redlined areas and current non-white segregation levels, and an even stronger association between previously A-rated HOLC areas and current levels of white segregation. Moreover, we showed that the targeting of highway development in redlined areas is connected to higher present-day concentrations of people of color near highways, and that highway proximity has a significant positive correlation with PM2.5 exposure, especially in formerly redlined communities. Overall, we delineated how people of color in California experience health issues and discrimination due to segregation and pollution exposure that stem from the state's racist history of redlining and highway development, and that these ongoing harms have yet to be fully addressed.

Building on these findings, research was conducted into policies that the State of California could pursue to advance environmentally just and equitable solutions to these problems. Four potentially fruitful policy approaches were identified – designing policies that focus explicitly on race and ethnicity, changing zoning and planning goals, increasing community empowerment and decision-making authority, and increasing the accessibility of data – and specific policy proposals within those approaches were analyzed. The analysis yielded eight policies that the state should implement to better address the ongoing impacts of its discriminatory history of redlining and highway development, with zoning and planning policies being the most effective overall policy approach.

Although this project represents a comprehensive effort, given our time and capacity constraints, this topic warrants future analysis and exploration. There are many lasting impacts of redlining and highway development beyond PM2.5 pollution and segregation that researchers could study in detail. Additionally, there is room to expand our case studies of Stockton and Los Angeles to include the other six formerly redlined cities in California. Research into the legacies of redlining and transportation development in other states, as well as the policy efforts that have been made to address them, would also be valuable.

We envision this project serving as a valuable reference for decision-makers at the state, regional, and local levels. Our maps and findings from this report can be explored visually on OEHHA's Pollution and Prejudice story map.[130] It is crucial that California addresses the detrimental impacts of redlining and highway development to foster an environment that brings about true justice and opportunity for communities of color.

130 Available in June 2024 at **Link.**

6

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Dicklyon / Wikimedia Commons

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7

APPENDIX

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7. APPENDIX

7.1. Chapter 2 - Methodology

2.1

To identify sources from our UCLA network, we explored the UC Library system and similar scholarly databases and solicited recommendations from professors and scholars – principally our UCLA Project Advisor, Dr. Michael Stoll – with relevant expertise related to the research topic. Through OEHHA, we not only considered resource recommendations from the policy professionals we worked with directly on the project, but also reached out to contacts in other state agencies, including CalTrans and California Air Resources Board (CARB), who held unique insights into our research topic.

2.2

To conduct the spatial analysis, the study used data on historical redlining areas from the University of Richmond's Mapping Inequality Project, data on racial demographics and median household income from the U.S. Census Bureau's 2021 American Community Survey 5-year estimates, data on California Highways from CalTRANS, data on PM2.5 levels collected in 2021 from CalEnviroscreen 4.0, and data on segregation levels from UC-Berkeley's The Roots of Structural Racism Project.

2.3

The tables below detail the methods behind the creation of the census tract-level *Highway Proximity* index variable used as an independent variable in Model 1 and Model 2:

Criteria	Weight
# of Highways within 1 mi.	4
Distance of nearest highway	4
Bisecting Highway (Y/N)	2
Total	**10**

# of Highways within 1 mi.	
Range	**Score**
0	0
1	1
2–3	2
4	3
5–6	4

Distance of nearest highway	
Range	**Score**
3.09–5.54 mi.	0
1.92–3.09 mi.	1
1.15–1.92 mi.	2
0.57–1.15 mi.	3
0.0006–0.57 mi.	4

Bisecting Highway (Y/N)	
Range	**Score**
No (0)	0
Yes (1)	2

We used tools in ArcGIS Pro to calculate all three components of this index. To identify the number of highways near a census tract, we instructed ArcGIS to select the number of observations in the CalTrans highway data set that were within 1 mile of the census tract's border. To calculate the exact proximity of the closest highway to every census tract, we had ArcGIS Pro locate the center point of every census tract and then calculate the distance from that center point to the nearest highway in the CalTrans data set. To identify whether a census tract was bisected by a highway, we had ArcGIS Pro select all tracts that contained a CalTrans highway within their borders. We then ran sensitivity tests by altering the weights of each of the three components by 5% (0.5 points) in either direction. None of these tests changed the direction or statistical significance of the relationships with the independent variable *highway proximity* in any of our regression models, nor did they change the magnitude of the relationships to a statistically significant level. Thus, the sensitivity tests ensure the robustness of the index.

2.4

The regressions in the study used census tract-level data from CalEnviroscreen 4.0 published in 2021 and spatial analysis tools in ArcGIS Pro to add new key variables for its regression models. The study created Redlined and Green dummy variables, for which census tracts were assigned a value of 1 if their center point was within a quarter-mile of a formerly-red or green HOLC area respectively, and a value of 0 if not. It also created a Highway Proximity variable which indexed three elements of highway proximity for each census tract and assigned a value of 0-10 to each census tract based on these elements described below. The study further added a Non-white Population variable for each census tract by inverting the percentage of the non-Hispanic white population living in that census tract. Other control variables the study created were Population Density for each census tract and a Citywide Non-White Population statistic assigned to each census tract based on the city it was located in. A full list of the variables already included in the CalEnviroscreen 4.0 data can be found by viewing the tool online. After creating these new variables, analysts used the resulting data to run the following two sets of fixed effects regression models to obtain results that would help answer the study's research questions.

2.5

Model 1 and Model 2 first use census tract-level data from California's eight formerly-redlined cities to test the effects of *Redlined* classifications, *Green* classifications, and *Highway proximity* on 2021 levels of *Non-white population*. The two models are designed identically except for the addition of an interaction term between *Redlined* and *Highway proximity* in Model 2, which captures the additional impact of highway proximity on a census tract's racial demographics when that census tract was previously redlined. Both models are included so that the study can analyze the baseline relationship of the dependent variable to all independent variables in the absence of an interaction term, as well as the predicted changes that occur when accounting for the interaction between the study's two critical independent variables. The model controls for the fixed effects of

each of the eight different cities in the data, which most notably includes the overall non-white population of the city. This means the regression controls for all differences in data between cities that may bias the relationships of interest.

2.6

Model 3 and Model 4 use the same data to test the effects of *Redlined* classifications, *Green* classifications, and *Highway proximity* on 2021 levels of *PM2.5 concentration*. Following the same logic as the prior set of models, the two models are identical except for the addition of an interaction term between *Redlined* and *Highway proximity* in Model 3, which captures the additional impact of highway proximity on a census tract's PM2.5 exposure when that census tract was previously redlined. The model controls for the population density of each census tract, as well as city-level fixed effects, which most notably includes overall citywide PM2.5 levels and other levels of related types of pollution such as Diesel Particulate Matter.

2.7

For more specific analysis, we applied the formulas from Model 1 and Model 2 to different subsections of our data set. These four different subsets represented urban areas, rural areas, Los Angeles, and Stockton. When testing the data sets of Los Angeles and Stockton, we get rid of the city fixed effects element and employ a simple multivariate regression. Models 5-20 in Appendix section 3.7 display these regressions. Subsequently, we use a Wald test to examine statistically significant differences between urban and rural areas, as well as between Los Angeles and Stockton.

Wald tests were used to test for statistical significant differences between two regressions. The formula used for the Wald test were:

Comparing urban and rural:

$$\text{Test statistic} = \frac{|\ Coefficient\ Urban - Coefficient\ Rural\ |}{\sqrt{(SE\ Urban)^2 - (SE\ Rural)^2}}$$

Comparing Los Angeles and Stockton:

$$\text{Test statistic} = \frac{|\ Coefficient\ Los\ Angeles - Coefficient\ Stockton\ |}{\sqrt{(SE\ Los\ Angeles)^2 - (SE\ Stockton)^2}}$$

At a 95% confidence interval, the test statistic was compared against the critical value z value of 1.96.

7.2. Chapter 3 - Problem Identification

3.1

Using the dataset described in Appendix 2.4, we calculated the mean poverty in formerly-redlined census tracts and weighted it by population, then calculated the mean poverty rate in all other census tracts and weighted it by population.

Results: μRedlinedPovertyRate = 46.003%, μNonRedlinedPovertyRate = 32.078%

3.2

Overlaying the CalTrans highway data with the University of Richmond data on all HOLC areas in ArcGIS Pro, we calculated the percentage of redlined areas in California that currently intersect with a highway, as well as the percentage of A, B, or C-rated areas that currently intersect with a highway. We then ran a two-sample Z-test on this difference in proportions of 77% compared to 49%, which yielded a p-value of .057e-8, meaning we could be more than 99.99% confident that this difference did not occur due to random chance.

3.3

Using the dataset from Appendix 2.4, we calculated the mean number of highways within 0.75 miles of all redlined census tracts, as well as the mean number of highways within 0.75 miles of all A-rated census tracts.

Results:

- μred = 2.25 highways
- μgreen = 1.26 highways

We then conducted a two-sample T-test on these sample means to determine if the difference was statistically significant, which it was at a p-value = .013e-12 (> 99.999% confidence).

3.4

Using the dataset from Appendix 2.4, we calculated the mean distance of the nearest highway to the geographical center of all redlined census tracts, as well as the mean distance of the nearest highway to the geographical center of all A-rated census tracts.

Results:

- μred = 0.62 miles
- μgreen = 1.1 miles

We then conducted a two-sample T-test on these sample means to determine if the difference was statistically significant, which it was at a p-value = .092e-8 (> 99.999% confidence).

3.5

Data on segregation levels comes from the Othering and Belonging Institute at UC Berkeley and their Roots of Structural Racism Project, which was published in 2021. This study paired their census tract-level segregation data with the University of Richmond's Mapping Inequality project data on former HOLC risk classification areas to assign each census tract in the eight formerly-redlined cities of California both a HOLC risk grade and a segregation level. It then used these two variables to calculate the statistics on segregation for redlined and A-rated areas.

3.6

99.9% confidence intervals were created for each of the eight formerly redlined cities in California by calculating a proportion confidence interval using the following parameters:

- Sample size (*N*) = µCensus Tract Population
- Population probability (*P*) = Citywide % of non-white population
- $x = N * P$

Here were the exact confidence intervals for non-white population by census tracts for each of the eight cities:

- Los Angeles: +/- 2.33%
- Stockton: +/- 1.9%
- San Diego: +/- 2.34%
- San Francisco: +/- 2.41%
- San Jose: +/- 1.98%
- Sacramento: +/- 2.2%
- Fresno: +/- 2.11%
- Oakland: +/- 2.38%

3.7

Models 5-12

Model 5 & Model 6

	Dependent variable:	
	NonWhite	
	Los Angeles	Stockton
	(1)	(2)
Redlined	12.142***	18.883**
	(1.723)	(5.610)
Green	-33.988***	-24.148**
	(3.174)	(8.927)
HWprox	1.479***	-0.743
	(0.314)	(0.709)
Constant	62.225***	80.567***
	(1.705)	(3.308)
Observations	991	59
R2	0.195	0.272
Adjusted R2	0.193	0.232
Residual Std. Error	23.695 (df = 987)	12.368 (df = 55)
F Statistic	79.789*** (df = 3; 987)	6.843*** (df = 3; 55)
Note:		*p<0.05; **p<0.01; ***p<0.001

Model 7 & Model 8

	Dependent variable:	
	NonWhite	
	Urban	Rural
	(1)	(2)
Redlined	11.515***	-0.041
	(1.449)	(2.840)
Green	-29.128***	-28.781***
	(2.546)	(6.339)
HWprox	0.763**	2.198***
	(0.267)	(0.332)
Observations	1,299	456
R2	0.199	0.179
Adjusted R2	0.196	0.168
Residual Std. Error	23.087 (df = 1293)	17.679 (df = 449)
Note:		*p<0.05; **p<0.01; ***p<0.001

Model 9 & Model 10

	Dependent variable:	
	NonWhite	
	Los Angeles	Stockton
	(1)	(2)
Redlined	8.883*	20.029
	(4.153)	(23.196)
Green	-34.022***	-24.153**
	(3.175)	(9.009)
HWprox	1.314***	-0.734
	(0.367)	(0.737)
Redlined:HWprox	0.610	-0.156
	(0.708)	(3.056)
Constant	62.973***	80.532***
	(1.913)	(3.412)
Observations	991	59
R2	0.196	0.272
Adjusted R2	0.193	0.218
Residual Std. Error	23.698 (df = 986)	12.481 (df = 54)
F Statistic	60.012*** (df = 4; 986)	5.040** (df = 4; 54)
Note:		*p<0.05; **p<0.01; ***p<0.001

Model 11 & Model 12

	Dependent variable:	
	NonWhite	
	Urban	Rural
	(1)	(2)
Redlined	13.200***	20.358*
	(3.591)	(9.634)
Green	-29.118***	-28.751***
	(2.547)	(6.312)
HWprox	0.848**	2.391***
	(0.314)	(0.342)
Redlined:HWprox	-0.303	-2.949*
	(0.590)	(1.331)
Observations	1,299	456
R2	0.199	0.188
Adjusted R2	0.195	0.176
Residual Std. Error	23.093 (df = 1292)	17.603 (df = 448)
Note:		*p<0.05; **p<0.01; ***p<0.001

Null hypothesis: There is no statistically significant difference between the 8 urban and rural cities in California.

Wald Test values:

- **Redlined: | 3.62487553 | > |1.96|, Can reject the null hypothesis**
- Green: |-0.05081071| < |1.96|, Fail to reject the null hypothesis
- **HWprox: |-3.36682480| > |1.96|, Can reject the null hypothesis**

Null hypothesis: There is no statistically significant difference between Los Angeles and Stockton.

Wald Test values

- Redlined: | 1.148772 |< |1.96|, Fail to reject the null hypothesis
- Green: |1.038601|< |1.96|, Fail to reject the null hypothesis
- **HWprox: |2.865382|> |1.96|, Can reject the null hypothesis**

Null hypothesis: There is no statistically significant difference between the 8 urban and rural cities in California.

Wald Test values

- Redlined: |0.69619795|< |1.96|, Fail to reject the null hypothesis
- Green: |0.05395146|< |1.96|, Fail to reject the null hypothesis
- **HW prox: |3.32260686|> |1.96|, Can reject the null hypothesis**
- Red*HWprox: |1.81678505|< |1.96|, Fail to reject the null hypothesis

Null hypothesis: There is no statistically significant difference between Los Angeles and Stockton.

Wald Test values

- Redlined:| -0.4729896 | < |1.96|, Fail to reject the null hypothesis
- Green: | -1.0331063 | < |1.96|, Fail to reject the null hypothesis
- **HWprox: |2.4864457| > |1.96|, Can reject the null hypothesis**
- Red*HWprox: |0.2441454|< |1.96|, Fail to reject the null hypothesis

Models 13-20

Model 13 & Model 14

	Dependent variable:	
	PM2_5	
	Los Angeles	Stockton
	(1)	(2)
Redlined	0.261***	0.561**
	(0.034)	(0.177)
HWprox	0.005	0.024
	(0.006)	(0.022)
Green	-0.100	0.237
	(0.062)	(0.281)
Constant	11.765***	10.934***
	(0.033)	(0.104)
Observations	996	59
R2	0.070	0.252
Adjusted R2	0.068	0.212
Residual Std. Error	0.462 (df = 992)	0.390 (df = 55)
F Statistic	25.048*** (df = 3; 992)	6.190** (df = 3; 55)
Note:		*p<0.05; **p<0.01; ***p<0.001

Model 15 & Model 16

	Dependent variable:	
	PM2_5	
	Urban	Rural
	(1)	(2)
Redlined	0.192***	0.264***
	(0.027)	(0.040)
HWprox	0.012*	0.046***
	(0.005)	(0.005)
Green	-0.052	0.054
	(0.048)	(0.090)
Observations	1,304	456
R2	0.900	0.986
Adjusted R2	0.899	0.986
Residual Std. Error	0.431 (df = 1298)	0.250 (df = 449)
Note:		*p<0.05; **p<0.01; ***p<0.001

Model 17 & Model 18

	Dependent variable:	
	PM2_5	
	Los Angeles	Stockton
	(1)	(2)
Redlined	-0.142	0.241
	(0.080)	(0.730)
HWprox	-0.015*	0.022
	(0.007)	(0.023)
Green	-0.104	0.238
	(0.061)	(0.283)
Redlined:HWprox	0.075***	0.043
	(0.014)	(0.096)
Constant	11.857***	10.944***
	(0.037)	(0.107)
Observations	996	59
R2	0.098	0.255
Adjusted R2	0.095	0.200
Residual Std. Error	0.455 (df = 991)	0.393 (df = 54)
F Statistic	27.053*** (df = 4; 991)	4.626** (df = 4; 54)
Note:		*p<0.05; **p<0.01; ***p<0.001

Model 19 & Model 20

	Dependent variable:	
	PM2_5	
	Urban	Rural
	(1)	(2)
Redlined	-0.156*	0.355**
	(0.066)	(0.137)
HWprox	-0.006	0.047***
	(0.006)	(0.005)
Green	-0.054	0.054
	(0.047)	(0.090)
Redlined:HWprox	0.062***	-0.013
	(0.011)	(0.019)
Observations	1,304	456
R2	0.902	0.986
Adjusted R2	0.902	0.986
Residual Std. Error	0.426 (df = 1297)	0.250 (df = 448)
Note:		*p<0.05; **p<0.01; ***p<0.001

Null hypothesis: There is no statistically significant difference between the 8 urban and rural cities in California.

Wald Test values

- Redlined: |-1.488367|. Fail to reject the null hypothesis.
- **HWprox: |-5.031918|> |1.96|, Can reject the null hypothesis.**
- Green: |-1.047843|. Fail to reject the null hypothesis.

Null hypothesis: There is no statistically significant difference between Los Angeles and Stockton.

Fail to reject the null hypothesis for all.

Wald Test values

- Redlined: |-1.6672988|
- HWprox: |-0.8337777|
- Green: |-1.1685054|

Null hypothesis: There is no statistically significant difference between the 8 urban and rural cities in California.

Wald Test values

- **Redlined: |-3.367458 |> |1.96|, Can reject the null hypothesis.**
- **HWprox: |-6.985343|> |1.96|, Can reject the null hypothesis.**
- Green: | -1.072796 |. Fail to reject the null hypothesis.
- **Red*HWprox: |-2.254027| > |1.96|, Can reject the null hypothesis.**

Null hypothesis: There is no statistically significant difference between Los Angeles and Stockton.

Fail to reject the null hypothesis for all.

Wald Test values

- Redlined: |-0.5219282|
- HWprox: |-1.5232856|
- Green: |-1.1806447|
- Red*HWprox: |0.3286962|

We also conducted a series of regressions to investigate the effects of independent

variables on non-white population levels and PM2.5 levels between urban and rural areas, as well as between Los Angeles and Stockton.

Beginning with a naive regression, each model progressively introduced independent variables Redlined, HwProx, Green, and an interaction term of Redlined*HwProx were added one regression at the time to isolate their resulting effects on either the Urban or LAvStock variable. To calculate the impact of each variable on the Urban or LAvStock coefficient, the marginal percent change was calculated using the formula below. Overall, the results of these models aimed to illustrate the impact of redlining and highway development on present day racial segregation levels and PM2.5 levels in California.

The tables below show naive regressions and the resulting outputs of the differences

$$Percent\ Change\ = \frac{(V2 - V1)}{|V1|} \times 100$$

between rural and urban as well as Los Angeles and Stockton on racial segregation and PM2.5 levels.

Racial Segregation

Regression	Intercept	Urban and Rural Comparison	Redlined	HWProx	Green	Redlined*HwProx	Urban & Rural Marginal % Change
lm(NonWhite ~ urban)	71.692***	-1.408***					
lm(NonWhite ~ urban + Redlined)	69.941***	-4.244***	15.560***				-201.42%
lm(NonWhite ~ urban + Redlined + HWprox)	63.980***	-4.575***	13.850***	1.391***			-7.80%
lm(NonWhite ~ urban + Redlined + HWprox + Green)	65.012***	-2.424***	11.035***	1.342***	-33.248***		47.02%
lm(NonWhite ~ urban + Redlined HWprox + Redlined*HWprox + Green)	9.678***	2.060***	0.021***	0.009*	-0.011***	-0.225***	184.98%

Regression	Intercept	Los Angeles and Stockton	Redlined	HWProx	Green	Redlined*HwProx	LA & Stockton Marginal % Change
lm(NonWhite ~ lavstock)	78.713***	-7.948***					
lm(NonWhite ~ lavstock + Redlined)	76.732***	-10.736***	16.702***				-35.08%
lm(NonWhite ~ lavstock + Redlined + HWprox)	70.155***	-11.125***	14.998***	1.538***			-3.62%
lm(NonWhite ~ lavstock + Redlined + HWprox + Green)	71.938***	-9.681***	12.148***	1.472***	-33.972***		12.98%
lm(NonWhite ~ lavstock + Redlined + HWprox + Green + Redlined*HWprox)	72.506***	-9.495***	8.860***	1.306***	-34.006***	0.615***	1.92%

The coefficient for the urban variable, displayed in the Urban and Rural comparison column, slightly changes as independent variables are added to the model. The first regression shows that rural areas have a higher level of non-white population compared to urban areas. This coefficient increases by 201.42% for rural areas when controlling for redlining. Again, the coefficient increases by 7.8% when accounting for highway proximity. Similar trends are seen in the Los Angeles and Stockton regressions. Redlining accounts for a 35.08% increase in the Los Angeles and Stockton coefficient, the lavstock variable, as it increases from -7.948 to -10.736. Highway proximity increases this coefficient again by 3.62%. In both models, controlling for greenlining and the interaction term reduces the magnitude of the urban and lavstock variable coefficients. This is attributed to the influence of greenlining status and interaction effects explaining part of the observed effects.

Racial Segregation

Regression	Intercept	Urban and Rural Comparison	Redlined	HWProx	Green	Redlined*HwProx	Urban & Rural Marginal % Change
lm(NonWhite ~ urban	71.692***	-1.408***					
lm(NonWhite ~ urban + Redlined)	69.941***	-4.244***	15.560***				-201.42%
lm(NonWhite ~ urban + Redlined + HWprox)	63.980***	-4.575***	13.850***	1.391***			-7.80%
lm(NonWhite ~ urban + Redlined + HWprox + Green)	65.012***	-2.424***	11.035***	1.342***	-33.248***		47.02%
lm(NonWhite ~ urban + Redlined HWprox + Redlined*HWprox + Green)	9.678***	2.060***	0.021***	0.009*	-0.011***	-0.225***	184.98%

Regression	Intercept	Los Angeles and Stockton Comparison	Redlined	HWProx	Green	Redlined*HwProx	LA & Stockton Marginal % Change
lm(NonWhite ~ lavstock)	78.713***	-7.948***					
lm(NonWhite ~ lavstock + Redlined)	76.732***	-10.736***	16.702***				-35.08%
lm(NonWhite ~ lavstock + Redlined + HWprox)	70.155***	-11.125***	14.998***	1.538***			-3.62%
lm(NonWhite ~ lavstock + Redlined + HWprox + Green)	71.938***	-9.681***	12.148***	1.472***	-33.972***		12.98%
lm(NonWhite ~ lavstock + Redlined + HWprox + Green + Redlined*HWprox)	72.506***	-9.495***	8.860***	1.306***	-34.006***	0.615***	1.92%

PM2.5 Levels

Regression	Intercept	Urban and Rural Comparison	Redlined	HWProx	Green	Redlined*HwProx	Urban & Rural Marginal % Change
lm(PM2_5 ~ urban)	9.644***	2.063***					
lm(PM2_5 ~ urban + Redlined)	9.629***	2.039***	0.135***				-1.16%
lm(PM2_5 ~ urban + Redlined + HWprox)	9.651***	2.040***	0.141***	-0.005***			0.05%
lm(PM2_5 ~ urban + Redlined + HWprox + Green)	9.658***	2.054***	0.123***	-0.006***	-0.224***		0.69%
lm(PM2_5 ~ urban + Redlined + HWprox + Green + Redlined*HWprox)	9.678***	2.060***	0.009*	-0.011***	-0.225***	0.021***	0.29%

Regression	Intercept	Los Angeles and Stockton Comparison	Redlined	HWProx	Green	Redlined*HwProx	LA & Stockton Marginal % Change
lm(PM2_5 ~ lavstock)	11.115***	0.742***					
lm(PM2_5 ~ lavstock + Redlined)	11.083***	0.696***	0.276***				-6.20%
lm(PM2_5 ~ lavstock + Redlined + HWprox)	11.060***	0.695***	0.270***	0.005***			0.14%
lm(PM2_5 ~ lavstock + Redlined + HWprox + Green)	11.065***	0.699***	0.261***	0.005***	-0.099***		0.43%
lm(PM2_5 ~ lavstock + Redlined + Green + HWprox+ Redlined*HWprox)	11.134***	0.722***	-0.141***	-0.015***	-0.103***	0.075***	3.29%

These tables reflect higher PM2.5 levels in urban areas and Los Angeles than rural areas and Stockton. In both, the comparison coefficient changes slightly when accounting for redlining, highway proximity, and greenlining. With the final inclusion of the interaction term, both coefficients increase slightly when capturing the combined effects of redlining and highway proximity.

3.8

Here are the respective mean annual averages of PM2.5 concentration in California's eight formerly-redlined cities – for both the formerly redlined census tracts and the city overall:

Los Angeles: Redlined = 12.05 μg/m^3, Overall = 11.86 μg/m^3

Stockton: Redlined = 11.68 μg/m^3, Overall = 11.11 μg/m^3

Sacramento: Redlined = 9.14 μg/m^3, Overall = 8.92 μg/m^3

San Diego: Redlined = 10.27 μg/m^3, Overall = 9.96 μg/m^3

San Francisco: Redlined = 8.64 μg/m^3, Overall = 8.62 μg/m^3

San Jose: Redlined = 8.92 μg/m^3, Overall = 8.49 μg/m^3

Fresno: Redlined = 13.79 μg/m^3, Overall = 13.59 μg/m^3

Oakland: Redlined = 9.29 μg/m^3, Overall = 9.18 μg/m^3

These statistics were calculated using data from CalEnviroscreen 4.0 for census tract-level PM2.5 concentration, as well as data from the University of Richmond's Mapping Inequality project to select the historical HOLC classifications of each census tract using tools in ArcGIS Pro.

7.3. Chapter 4 - Policy Options

4.1: Additional Policy Approaches

Our team conducted a content review of over 200 pieces of literature related to redlining and highway development in California. We coded emergent themes in each reading that provided policy options, recommendations, or analysis. To determine which readings provided policy options or analysis, we used the search terms “policy”, “recommend”, and “solution,” and also looked at the conclusion section or chapter of each reading, where appropriate.

The following points are additional policy approaches that emerged from our literature review. Though they are important to acknowledge, our team has determined these additional approaches do not warrant further evaluation in this project because of time and word count restraints for this report and their more tangential connections to our key criteria.

- **Funding/resources/investment:** there is more funding needed to fully address the impacts of redlining and highway development, and more investments are needed to complete projects that are alternatives to highways.
- **Research:** there is a need to produce more nuanced research that integrates spatial analysis and social sciences and humanities more broadly on this subject to better understand what solutions will be most effective.
- **Housing:** more affordable and higher-density housing is needed to mitigate the overarching housing crisis in California to, therefore, address segregation levels that have come as a result of redlining and highway development.

4.2: Additional Policy Options

Our team originally considered 27 policy options that emerged from our literature review. Collectively, the team performed an initial policy analysis and reorganization process to reduce the list to 14 final policy options to evaluate. If a policy option could not be consolidated elsewhere, the team voted on which policy options to eliminate using our key criteria as a guide. Policy options that received a majority vote (three or more votes out of a team of five) were eliminated.

Below is our list of additional policy options and the brief reason they were eliminated from the final list.

Policy Approach: Focus Explicitly on Race and Ethnicity

1. CalEPA should model policy behaviors that help the Justice40 Initiative and the Climate and Economic Justice Screening tool to better identify and prioritize communities by explicitly including race and ethnicity in its calculations of who can benefit
    a. Ensure any California legislation inspired by Justice40 includes an explicit recognition of race and ethnicity and/or formerly redlined communities
    b. Ensure federal agencies issuing funds to California prioritize formerly redlined communities and/or race and ethnicity
    c. Cultivate and highlight data that demonstrates that more just environmental outcomes can be produced by explicitly prioritizing race and ethnicity in program tenets.
    d. Justice40 originated from a New York law. The New York law has since changed the word "benefit" to "investment" in order to more accurately direct funding to "disadvantaged communities." CalEPA can advocate for changes of the word "benefit" in Justice40 and Justice40-like programs at the state level, to something like "investment" or the dollar amount of the investment. This would specifically direct funds and programs to communities, rather than this vague idea of "benefits."
    e. Require a racial and ethnicity equity analysis (like NOAA) on all Justice40 initiatives/projects/plans that score how well it addresses equity to mandate race and ethnicity considerations.

    ELIMINATION RATIONALE: This is similar to Policy Option #1 that was included in our final list. We consolidated other pieces of this option to our final list.

2. CARB should use Stockton's local diesel pollution regulations as a model to build a statewide diesel pollution policy.

    ELIMINATION RATIONALE: This did not appear to be a standalone policy option we could evaluate fairly. We felt other policy options could encapsulate a similar idea.

3. California Counties should use the fact that they're required to inventory and remove racial covenant language from historical documents as an opportunity to flag for areas in which to increase funding or target funding.

    ELIMINATION RATIONALE: We believed this policy option was too vague, and instead decided to include this information as context for key opportunities in our Policy Options Chapter.

4. Require jurisdictions to complete comprehensive racial equity impact studies prior to any construction of new or expanded transportation infrastructure, housing development, or industrial development. Racial equity impact studies can help ensure development is tailored toward dismantling the discriminatory legacies of redlining rather and highway development rather than further entrenching them.

> ELIMINATION RATIONALE: We believed this policy option was better suited under the "Make Data More Accessible" policy approach. We consolidated this policy option into our final list.

5. The California DOJ should mirror the federal government Combatting Redlining Initiative and should pursue cases against the eight formerly-redlined municipalities to compel them to provide investment to address the impacts of past redlining.

> ELIMINATION RATIONALE: We consolidated this policy option into our final list as a sub point of another option.

6. Leverage funding and program examples that were explicitly mentioned at this California State Assembly Select Committee on Reconnecting Communities' **committee hearing** and ensure they are race-specific. The committee is producing a report to the legislature.

> ELIMINATION RATIONALE: We felt this policy option may be covered in the Committee's eventual report and would require too much time to fully flesh out and vet as a separate policy option.

Policy Approach: Increase & Improve Community Empowerment and Decision-Making Authority

7. CalTrans should enforce and provide staff with adequate time and resources to follow the **Reconnecting Communities handbook**.

> ELIMINATION RATIONALE: We consolidated this idea into another policy option that was included in the final list.

8. For funds awarded to federally recognized tribal governments, state agencies should remove the requirement to submit a limited waiver of their sovereign immunity for purposes of contracting in cases where a waiver is not explicitly required by statute. This creates an unnecessary administrative burden and barrier.

> ELIMINATION RATIONALE: Up to this point in the report, we had not thoroughly discussed California Native American tribes and did not feel comfortable leaving in this recommendation without providing more background information, context, and policy options that focus on tribes.

Policy Approach: Use Zoning and Planning Goals

9. The State should create and fund new environmental justice planning requirements that counties and cities must include in their updated plans
    a. Institute requirements for jurisdictions to include Environmental Justice Impact Assessments in their Hazard Mitigation Plans that especially study racial inequities in environmental burdens, and for environmental justice goals to be included in their general plans based off of such assessments. State agencies should provide public resources and guidance to help jurisdictions implement these requirements in their updated plans.
    b. Provide funds to the eight formerly-redlined cities to be allocated to impact studies of redlining and implementation of plans that help redlined communities address its lasting impact.
    c. Integrate the history of redlining and highway development and its lasting impacts into the training of transportation planners and decision-makers
    d. Pass a state bill modeled after SB 379 (2017; climate adaptation planning standards) that provides requirements for cities to include certain EJ assessments in their hazard mitigation plan and EJ goals in their general plan. State agencies could provide public resources and guidance to help local jurisdictions in their efforts.
        i. Create requirements in CalEPA by revising the California Code of Regulations (ex. Title 27)

> ELIMINATION RATIONALE: We conducted further research on this policy option and consolidated parts of this into our final Policy Option #9.

10. CalEPA should ban types of development that would place further environmental stress on already overburdened communities.
    a. Ban highway expansion in areas that are subject to pollution levels above a certain threshold. Also require cities to review and amend land use designations so that they prevent further development of all high-polluting land uses in communities above said threshold. The Stockton General Plan and Stockton Port Clean Air Plan are prime models for these policies, and there are anti displacement and highway widening memos from CAlSTA we could reference.
    b. Prohibit by-right approval of the siting or expansion of polluting land uses near disadvantaged communities, and require project proponents to obtain a discretionary permit, such as a conditional use permit, in order to ensure that projects undergo individualized environmental review. Require local governments to make special findings that a project will not exacerbate environmental degradation or worsen public health outcomes when approving the project.
    c. Include strong enforcement measures of these and other guidelines
        i. Ex: Enforce laws about Urban Development fund use to ensure cities allocate 2-4% to affirmatively further fair housing, moratorium on foreclosures. Focusing environmental enforcement and compliance activity in communities that are the most vulnerable and the most burdened by multiple sources of pollution is a priority of the CalEPA Working Group and its partner agencies.

> ELIMINATION RATIONALE: We incorporated parts of this policy option into Policy Options #5 and #10. We were unsure which state agency(ies) this option would target specifically.

11. Address ongoing displacement in communities of color from transportation investments by incorporating ideas from the Climate Action Plan for Transportation Infrastructure (**CAPTI**) and these anti-displacement **memos**.

> ELIMINATION RATIONALE: We incorporated parts of this policy option into Policy Option #8 and reference the CAPTI in our policy context section.

12. Consider policies that focus on the benefits and needs of reconnecting communities.

> ELIMINATION RATIONALE: We believe the California State Assembly Select Committee on Reconnecting Communities would better evaluate this specific policy option. They are tasked with submitting a report to the Legislature in the coming year. We reference this committee in our Policy Options chapter. We also reference the Department of Transportation Re-Connecting Communities Plan in Policy Option #1.

Policy Approach: Make Data More Accessible

13. Ensure that coordinated outreach and application processes such as those used by Access Clean California72 are a formal program requirement for individual climate and transportation equity incentive programs going forward, particularly for programs that have clear overlap with existing programs in terms of geography, technology and proposed beneficiaries. A lack of coordination has been shown to cause inefficiencies and consumer confusion.

> ELIMINATION RATIONALE: We opted to make this policy option more general and include certain programs as examples of how to improve outreach and application processes.

14. CalEPA continue to work with USEPA to prioritize making enforcement engagement more transparent, solution-oriented, responsive to community needs, and sustained.

> ELIMINATION RATIONALE: We did not believe this policy option fit well under this policy approach. We instead incorporated part of this option into our policy context section.

4.3: Background on California American Indian Tribes

Tribal Policies and Programs

Tribal Nations in California represent a vital and vibrant part of the state's cultural fabric, history, and contemporary socio-political landscape. Despite the challenges and transformations they have faced over centuries, tribal communities remain active contributors to California's diversity and governance. With more than 100 tribes, these groups operate as sovereign governments, a status that affords them certain rights and responsibilities independent of state law, underscoring their importance in policy-making and research endeavors within the state.[1]

Sovereignty means that any policy development or research within or affecting these lands must involve the tribes as equal partners. Acknowledging their sovereignty not only respects their rights but also ensures that policies are more effective, culturally sensitive, and inclusive. This is especially critical in areas such as environmental management, where Indigenous knowledge can play a key role and tailored approaches are necessary to address community-specific needs.

The concept of sovereignty is central to understanding the role of American Indian tribes in California today. As sovereign entities, these tribes possess the right to govern themselves, make and enforce laws, tax, establish membership criteria, and manage

1 California Tribal Communities - Tribal_projects," n.d. **Link**.

their lands and resources. This status is recognized at the federal level and entails a government-to-government relationship between tribes and the United States.

The inclusion of Tribal Nations in community engagement and policy discussions in California has been growing, yet it remains an area requiring continuous effort and improvement. Initiatives such as consultation policies, where state agencies are required to consult with tribes on actions that may affect them, represent steps in the right direction. However, the effectiveness of such measures depends on the genuine commitment to listening to and incorporating the input of Native communities.

Inviting tribes to the conversation not only acknowledges their sovereignty but also leverages their unique perspectives and wisdom, enriching policy-making and community initiatives. There are instances of successful collaboration in environmental stewardship, cultural heritage preservation, and economic development that showcase the potential of such engagements as demonstrated in the Inflation Reduction Act. Its inclusion of funding for tribal climate resilience and energy programs represents a significant step in bolstering support for Tribal Nations. It is the expectation for both the Administration and Congress to continue supporting tribal climate change initiatives as a means to uphold and fulfill the commitments made to tribal communities.[2] While our team was unable to deliberately incorporate intentional research, analysis, and evaluation of policies with a focus on tribes, we remain hopeful that future research on this topic can be explored.

2 The White House. "Inflation Reduction Act Guidebook | Clean Energy | The White House," December 5, 2023. **Link**.

7.4. Chapter 5 - Policy Evaluation

5.1: Promotion of environmental justice principles weight explanations

These five questions are based on the environmental justice principles established by the People of Color Environmental Leadership Summit in 1991. Out of the 17 principles established by the Summit, the questions focus on five particular principles that best encapsulate the desired goals of environmental justice policies and have particular relevance to the history and impacts of redlining and highway development in California. The full list of environmental justice principles can be found online.[3]

All of the sub-questions have equal weight, as they are all core components of environmental justice. Within the overall policy evaluation, we weighted the environmental justice criterion highly because the history of redlining and highway development in the state has entrenched environmental injustices that persist throughout the state today. Any policy seeking to address that history should thoroughly adhere to these core environmental justice principles.

5.2: Reduction of PM2.5 Pollution and/or Racial Segregation weight explanations

The impacts of PM2.5 pollution and residential racial segregation into the same criterion because they are both discriminatory legacies of the same history of redlining and highway development in California. Thus, policies oriented towards promoting justice for the communities who suffer from that history may touch on both impacts. The three sub-questions focusing on PM2.5 pollution burden are worth 15 points in total. We weighted them to ensure this criterion elevates the need to alleviate the disproportionate pollution burden on non-white communities in California, while also recognizing the benefits of policies that reduce PM2.5 concentration generally. The two sub-questions on segregation are also worth 15 points in total. We weighted them to prioritize policies that break down the systemic foundation of residential segregation, rather than just providing means to mitigate its harms without confronting the root cause.

5.3: Socio-Political Feasibility weight explanations

These sub-questions form a broader evaluation of how likely a policy is to be officially adopted. We included the final sub-questions to ensure the criterion pays special attention to the voices of the communities most impacted by a given policy. The weights reinforce the environmental justice tenants about the need to empower communities to make decisions about their futures. We gave a lower weight to the sub-question considering future support because it is both harder to measure with certainty and less

3 Environmental Justice Network, “Principles of Environmental Justice,” accessed April 6, 2024, **Link**.

relevant to the task of recommending policies for immediate implementation. We included the sub-question addressing a policy's capacity to be adopted without a law or a ballot measure and weighted it highly because bypassing the need to rely on votes greatly increases the political feasibility of that policy being adopted.

5.4: Efficacy weight explanations

Together, these sub-questions evaluate the likelihood of a policy producing its intended effect. Cost-effectiveness is the most important consideration for this criterion, as a policy cannot be holistically evaluated while ignoring its costs. We also recognized the importance of evaluating the realistic capacity of agencies to achieve the full potential of a policy when putting it into practice, and thus weighted these two sub-questions the highest within the efficacy category. This criterion also considers implementation speed and the potential for roadblocks not otherwise considered to stymie the desired outcomes of a proposed policy.

5.5: Generalizability weight explanations

This criterion is important to consider how applicable a given policy may be across widely differing jurisdictions within the diverse State of California. Additionally, while this study and its policy recommendations are unique to California, the federal policy program of redlining existed across the United States and likely produced similar environmental injustices throughout the more than 400 cities assessed by HOLC. Therefore, it is equally important for this criterion to consider the potential added benefits of a policy that could also be exported beyond California to advance environmental and racial justice nationally.

5.6: Criteria Score Coding Breakdown

We calculated ranges for what scores constituted a strength, extreme strength, weakness, or extreme weakness within each policy evaluation criterion. These ranges were based on a weighted average of the natural breaks of all the scores we assigned across that evaluation criterion and the even breaks across the full range of possible scores. The exact ranges for each category are listed below:

Promotion of Environmental Justice Principles:

- Extreme strength: > 19 points
- Strength: 17-19 points
- Weakness: 10-12.5 points
- Extreme weakness: < 10 points

Reduction of PM2.5 and/or racial segregation:

- Extreme strength: > 17.5 points
- Strength: 17.5-15.1 points
- Weakness: 11-8 points
- Extreme weakness: < 8 points

Socio-political feasibility:

- Extreme strength: > 16 points
- Strength: 14.5-16 points
- Weakness: 9-10.4 points
- Extreme weakness: < 9 points

Efficacy:

- Extreme strength: > 12.5 points
- Strength: 10.1-12.5 points
- Weakness: 6-7.9 points
- Extreme weakness: < 6 points

Generalizability:

- Extreme strength: N/A
- Strength: 6 points
- Weakness: 3.5-2 points
- Extreme weakness: < 2 points

5.7: Full CAM matrixes

"Focus Explicitly on Race and Ethnicity" Policy Option Scores

Promotion of Environmental Justice Principles	Max Points	Option 1 Points	Option 2 Points	Option 3 Points	Option 4 Points
Does the policy help enforce the right of communities to be free from ecological destruction?	6	3	4	1	3
Is the policy based on mutual respect and justice for all peoples, free from any form of discrimination or bias?	6	4	4	5	3
Does the policy protect or establish the right of communities to participate as equal partners at every level of decision making (needs assessment, planning, implementation, enforcement, and evaluation)?	6	4	2	1	0
Does the policy protect or promote the right of victims of environmental injustice to receive full compensation and reparations for damages?	6	4	1	2	5
Does the policy help mandate the right to ethical, balanced, and responsible uses of land and renewable resources in the interest of a sustainable planet for humans and other living things?	6	1	4	0	0
Total Points	**30**	**16**	**15**	**9**	**11**

Reduction of PM 2.5 Pollution and/or Racial Segregation	Max Points	Opt 1 Points	Opt 2 Points	Opt 3 Points	Opt 4 Points
Does the policy help reduce the burden of PM 2.5 pollution on formerly redlined communities/communities of color in California?	7	4	6	1	0
Does the policy help reduce the high levels of residential racial segregation in California connected to its histories of redlining and highway development?	10	1	0	8	2
Does the policy help address other harms to communities of color that stem from residential racial segregation?	5	3	2	3	1
Does the policy help meaningfully reduce overall levels of PM2.5 pollution levels?	4	2	4	1	0
Does the policy help reduce the burden of related pollutants (diesel particulate matter, PM 10, more) on formerly redlined communities/communities of color in California?	4	2	4	1	0
Total Points	**30**	**12**	**16**	**14**	**3**

Socio-Political Feasibility	Max Points	Opt 1 Points	Opt 2 Points	Opt 3 Points	Opt 4 Points
How much political support is there for the policy?	3	2	2	2	2
How much political opposition is there to the policy?	3	2	1	1	2
Is there a reason to think support for the policy might increase in the future?	2	1	1	1	2
Could the policy be officially adopted without the legislature or a ballot measure?	4	2	4	2	1
What is the level of support for the policy amongst the communities it seeks to support?	4	4	3	3	3
Did communities facing environmental injustice in California participate in developing and advocating for the policy?	4	3	3	2	3
Total Points	**20**	**14**	**14**	**11**	**13**

Efficacy	Max Points	Opt 1 Points	Opt 2 Points	Opt 3 Points	Opt 4 Points
What are the monetary and social costs of the policy, relative to its designed impacts	6	3	3	4	1
How manageable would it be to implement and administer the policy?	4	3	3	2	1
How long would it take for the policy to begin producing meaningful impacts?	2	1	1	1	2
Are there foreseeable scenarios that would cause the policy to become ineffective or irrelevant in the near future?	2	1	1	1	1
Total Points	**14**	**8**	**8**	**8**	**5**

Generalizability	Max Points	Opt 1 Points	Opt 2 Points	Opt 3 Points	Opt 4 Points
Can the policy be effective across jurisdictions with different socioeconomic, environmental, and cultural characteristics in California?	3	3	3	2	3
Can the policy be an effective model for jurisdictions outside California?	3	2	2	2	3
Total Points	**6**	**5**	**5**	**4**	**6**

Cumulative Total Points	100	55	58	46	38

"Increase and Improve Community Empowerment and Decision-Making Authority" Policy Option Scores

Promotion of Environmental Justice Principles	*Max Points*	*Option 5 Points*	*Option 6 Points*	*Option 7 Points*
Does the policy help enforce the right of communities to be free from ecological destruction?	6	5	5	3
Is the policy based on mutual respect and justice for all peoples, free from any form of discrimination or bias?	6	5.5	6	6
Does the policy protect or establish the right of communities to participate as equal partners at every level of decision making (needs assessment, planning, implementation, enforcement, and evaluation)?	6	1.5	2	0
Does the policy protect or promote the right of victims of environmental injustice to receive full compensation and reparations for damages?	6	3	1	0
Does the policy help mandate the right to ethical, balanced, and responsible uses of land and renewable resources in the interest of a sustainable planet for humans and other living things?	6	3	4	0
Total Points	**30**	**18**	**18**	**9**

Reduction of PM 2.5 Pollution and/or Racial Segregation	*Max Points*	*Option 5 Points*	*Option 6 Points*	*Option 7 Points*
Does the policy help reduce the burden of PM 2.5 pollution on formerly redlined communities/communities of color in California?	7	6	6	0
Does the policy help reduce the high levels of residential racial segregation in California connected to its histories of redlining and highway development?	10	2	2	0
Does the policy help address other harms to communities of color that stem from residential racial segregation?	5	3	3	0
Does the policy help meaningfully reduce overall levels of PM2.5 pollution levels?	4	2	2	0
Does the policy help reduce the burden of related pollutants (diesel particulate matter, PM 10, more) on formerly redlined communities/communities of color in California?	4	3	2	0
Total Points	**30**	**16**	**15**	**0**

Socio-Political Feasibility	*Max Points*	*Option 5 Points*	*Option 6 Points*	*Option 7 Points*
How much political support is there for the policy?	3	1	1	1
How much political opposition is there to the policy?	3	1	1	1
Is there a reason to think support for the policy might increase in the future?	2	1	1	1
Could the policy be officially adopted without the legislature or a ballot measure?	4	1	1	1
What is the level of support for the policy amongst the communities it seeks to support?	4	3.5	3	3.5
Did communities facing environmental injustice in California participate in developing and advocating for the policy?	4	3	3	4
Total Points	**20**	**10.5**	**10**	**11.5**

Efficacy	*Max Points*	*Option 5 Points*	*Option 6 Points*	*Option 7 Points*
What are the monetary and social costs of the policy, relative to its designed impacts	6	3	3	3.5
How manageable would it be to implement and administer the policy?	4	1.5	1.5	1
How long would it take for the policy to begin producing meaningful impacts?	2	1	1	1
Are there foreseeable scenarios that would cause the policy to become ineffective or irrelevant in the near future?	2	1	1	1
Total Points	**14**	**6.5**	**6.5**	**6.5**

Generalizability	*Max Points*	*Option 5 Points*	*Option 6 Points*	*Option 7 Points*
Can the policy be effective across jurisdictions with different socioeconomic, environmental, and cultural characteristics in California?	3	3	3	2.5
Can the policy be an effective model for jurisdictions outside California?	3	3	3	2
Total Points	**6**	**6**	**6**	**4.5**

Cumulative Total Points	100	57	55.5	31.5

"Use Zoning and Planning Goals" Policy Option Scores

Promotion of Environmental Justice Principles	***Max Points***	*Option 8 Points*	*Option 9 Points*	*Option 10 Points*
Does the policy help enforce the right of communities to be free from ecological destruction?	6	5	2	6
Is the policy based on mutual respect and justice for all peoples, free from any form of discrimination or bias?	6	6	6	5
Does the policy protect or establish the right of communities to participate as equal partners at every level of decision making (needs assessment, planning, implementation, enforcement, and evaluation)?	6	3	3.5	0
Does the policy protect or promote the right of victims of environmental injustice to receive full compensation and reparations for damages?	6	1	3	3
Does the policy help mandate the right to ethical, balanced, and responsible uses of land and renewable resources in the interest of a sustainable planet for humans and other living things?	6	2	2	4
Total Points	**30**	**17**	**16.5**	**18**

Reduction of PM 2.5 Pollution and/or Racial Segregation	***Max Points***	*Option 8 Points*	*Option 9 Points*	*Option 10 Points*
Does the policy help reduce the burden of PM 2.5 pollution on formerly redlined communities/communities of color in California?	7	7	2.5	6.5
Does the policy help reduce the high levels of residential racial segregation in California connected to its histories of redlining and highway development?	10	2	10	1
Does the policy help address other harms to communities of color that stem from residential racial segregation?	5	2.5	4	1
Does the policy help meaningfully reduce overall levels of PM2.5 pollution levels?	4	2.5	1	2
Does the policy help reduce the burden of related pollutants (diesel particulate matter, PM 10, more) on formerly redlined communities/communities of color in California?	4	4	2	4
Total Points	**30**	**18**	**19.5**	**14.5**

Socio-Political Feasibility	***Max Points***	*Option 8 Points*	*Option 9 Points*	*Option 10 Points*
How much political support is there for the policy?	3	1.5	3	3
How much political opposition is there to the policy?	3	1	1	3
Is there a reason to think support for the policy might increase in the future?	2	2	1	2
Could the policy be officially adopted without the legislature or a ballot measure?	4	3.5	0.5	1
What is the level of support for the policy amongst the communities it seeks to support?	4	3	1	3
Did communities facing environmental injustice in California participate in developing and advocating for the policy?	4	3	3	3.5
Total Points	**20**	**14**	**9.5**	**15.5**

Efficacy	***Max Points***	*Option 8 Points*	*Option 9 Points*	*Option 10 Points*
What are the monetary and social costs of the policy, relative to its designed impacts	6	2	5	6
How manageable would it be to implement and administer the policy?	4	1.5	3	3
How long would it take for the policy to begin producing meaningful impacts?	2	0	1	1.5
Are there foreseeable scenarios that would cause the policy to become ineffective or irrelevant in the near future?	2	0.5	0.5	2
Total Points	**14**	**4**	**9.5**	**12.5**

Generalizability	***Max Points***	*Option 8 Points*	*Option 9 Points*	*Option 10 Points*
Can the policy be effective across jurisdictions with different socioeconomic, environmental, and cultural characteristics in California?	3	2.5	1.5	3
Can the policy be an effective model for jurisdictions outside California?	3	2.5	2	3
Total Points	**6**	**5**	**3.5**	**6**

Cumulative Total Points	100	58	58.5	66.5

"Make Data More Accessible" Policy Option Scores

Promotion of Environmental Justice Principles	*Max Points*	*Option 11 Points*	*Option 12 Points*	*Option 13 Points*
Does the policy help enforce the right of communities to be free from ecological destruction?	6	2	1	1
Is the policy based on mutual respect and justice for all peoples, free from any form of discrimination or bias?	6	4	6	6
Does the policy protect or establish the right of communities to participate as equal partners at every level of decision making (needs assessment, planning, implementation, enforcement, and evaluation)?	6	1	0	0
Does the policy protect or promote the right of victims of environmental injustice to receive full compensation and reparations for damages?	6	3	4	2
Does the policy help mandate the right to ethical, balanced, and responsible uses of land and renewable resources in the interest of a sustainable planet for humans and other living things?	6	3	1	1
Total Points	**30**	**13**	**12**	**10**

Reduction of PM 2.5 Pollution and/or Racial Segregation	*Max Points*	*Option 11 Points*	*Option 12 Points*	*Option 13 Points*
Does the policy help reduce the burden of PM 2.5 pollution on formerly redlined communities/communities of color in California?	7	3	0	0
Does the policy help reduce the high levels of residential racial segregation in California connected to its histories of redlining and highway development?	10	0	2	0
Does the policy help address other harms to communities of color that stem from residential racial segregation?	5	4	2	1
Does the policy help meaningfully reduce overall levels of PM2.5 pollution levels?	4	0	0	0
Does the policy help reduce the burden of related pollutants (diesel particulate matter, PM 10, more) on formerly redlined communities/communities of color in California?	4	3	1	1
Total Points	**30**	**10**	**5**	**2**

Socio-Political Feasibility	*Max Points*	*Option 11 Points*	*Option 12 Points*	*Option 13 Points*
How much political support is there for the policy?	3	1.5	3	3
How much political opposition is there to the policy?	3	2	3	3
Is there a reason to think support for the policy might increase in the future?	2	2	2	2
Could the policy be officially adopted without the legislature or a ballot measure?	4	4	4	4
What is the level of support for the policy amongst the communities it seeks to support?	4	4	2	2
Did communities facing environmental injustice in California participate in developing and advocating for the policy?	4	0	0	0
Total Points	**20**	**13.5**	**14**	**14**

Efficacy	*Max Points*	*Option 11 Points*	*Option 12 Points*	*Option 13 Points*
What are the monetary and social costs of the policy, relative to its designed impacts	6	4	6	6
How manageable would it be to implement and administer the policy?	4	4	4	4
How long would it take for the policy to begin producing meaningful impacts?	2	2	1	0
Are there foreseeable scenarios that would cause the policy to become ineffective or irrelevant in the near future?	2	0	2	2
Total Points	**14**	**10**	**13**	**12**

Generalizability	*Max Points*	*Option 11 Points*	*Option 12 Points*	*Option 13 Points*
Can the policy be effective across jurisdictions with different socioeconomic, environmental, and cultural characteristics in California?	3	3	3	3
Can the policy be an effective model for jurisdictions outside California?	3	3	3	3
Total Points	**6**	**6**	**6**	**6**

Cumulative Total Points	100	52.5	50	44

5.8 Sensitivity Tests

To conduct our sensitivity test, we converted our category points to weights (ex: 30 points = .30 category weight). We then multiplied the points received in each category by the category weight to get its total score (ex: if a policy option received 15 out of 30 points in a category, its total score is .50).

We increased and decreased each category's weight by .04 and .08 to see if that changed our recommendation outcome. A change of .04 was selected to easily offset the change of one weight across the remaining criteria. A change of .08 was selected to investigate if a larger impact was needed to change our policy recommendations. As a note, criteria 5 had an original weight of .06 so we only subtracted .06 for that test and redistributed .15 to the other criteria instead of .20. Remember - we recommended policy options with a total score of .50 or higher.

Our top scoring policy options in each category remained the same after all sensitivity tests. The policy options we did not recommend never made it above a .50 threshold, and were never recommended on any of our sensitivity tests.

Policy Option #11 failed to reach the threshold twice: when the weight for criteria 2 was increased by .08 and when the weight for criteria 5 was decreased by .06.

Policy Option #12 failed to reach the threshold a total of ten times: when the weights for criteria 1 and 4 were increased by .04 and when the weights for criteria 3, 4, and 5 were decreased by .04. Similarly, it failed to reach the threshold for recommendation when the weights for criteria 1 and 4 were increased by .08, when the weights for criteria 3 and 4 were decreased by .08, and when the weight for criteria 5 was decreased by .06.

Although Policy Option #12 has a total score of .50 (50 points) on our initial evaluation, it failed the sensitivity test and was therefore not included in our final recommendation. Our sensitivity test results are in the table below.

How many times was the recommendation reversed?

Policy Option #	Original Total Score	First Round Sensitivity Test (+ or - .04 pts)	Second Round Sensitivity Test (+ or - .08 pts)*
1	0.55	0	0
2	0.58	0	0
3	0.46	0	0
4	0.38	0	0
5	0.57	0	0
6	0.555	0	0
7	0.315	0	0
8	0.58	0	0
9	0.585	0	0
10	0.665	0	0
11	0.525	0	2
12	0.5	5	5
13	0.44	0	0
Total	8 recommended	10 tests	10 tests

The table above illustrates the number of times a Policy Option recommendation status was changed in response to a sensitivity test. Column 1 is the Policy Option number. Column 2 is the original score of the Policy Option. Column 3 designates the number of times a Policy Option did not reach the policy option cutoff when the weights were changed by .04. Column 4 designates the number of times a Policy option did not reach the policy option cutoff when the weights were changed by 0.80. *Criteria 5 was subtracted by .06

To ensure that our results were significant, we conducted a binomial probability calculation using ChatGPT for Policy Options #11 and #12:

$$P(X = 18) = 190 \times (0.5)^{18} \times (1 - 0.5)^{2} \approx 0.000181$$

We found that there is a .018% chance that Policy Option #11 would fail two of our 20 significance tests if the true outcomes of recommending and rejecting the policy were equally likely. This means we can be >99.9% confident in recommending it.

$$P(X = 10) = 184{,}756 \times (0.5)^{10} \times (1 - 0.5)^{10} \approx 0.176$$

There is a 17.6% chance that Policy Option #12 would fail 10 of the 20 significance if the true outcomes of recommending and rejecting the policy were equally likely. Because of this, we are not confident enough to recommend Policy Option #12 as a priority at this time.