



EXPLORATION OF EMERGING METHODS TO ASSESS EQUITY IN USACE PROJECT PLANNING

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PREFACE

The Water Institute has supported the U.S. Army Corps of Engineers (USACE) and Engineering With Nature® (EWN) with policy research to better integrate and align traditional infrastructure approaches with Nature-based Solutions (NBS). A previous project, *Enhancing Benefits Evaluation for Water Resources Projects: Towards a More Comprehensive Approach for Nature Based Solutions* was completed in 2023 (Fischbach, Bond, et al., 2023). That policy research project used a retrospective case study analysis to explore how to best quantify, and potentially monetize, a more complete range of economic, environmental, and social costs and benefits provided by projects incorporating NBS. To better consider equity, a further research effort was devised, using the same case studies previously analyzed for NBS valuation. This report builds on the previous research project by using these case studies to test quantitative methods for incorporating equity considerations into project planning.

Questions about this research should be directed to the Director of Planning and Policy Research at The Water Institute, Jordan Fischbach (jfischbach@thewaterinstitute.org)



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EXECUTIVE SUMMARY

Federal investments in programs and infrastructure, including the Civil Works mission of the U.S. Army Corps of Engineers (USACE), are some of the most durable and impactful spending undertaken by the government; because this spending is so consequential, projects are carefully analyzed for impacts to communities, and the rules for these analyses matter a great deal for how projects are conceived, designed, and implemented. The Civil Works mission requires managing many of the Nation’s water resources, and as such, USACE must follow the Principles, Requirements and Guidelines (PR&G), the comprehensive policy and guidance for federal investments in water resources (Council on Environmental Quality [CEQ], 2013) and a framework for assessing economic, environmental, and social impacts. The policy and guidance also explicitly encourage agencies to integrate their PR&G analyses within existing planning processes and documents, such as those required by the National Environmental Policy Act (NEPA). While executive orders (EOs) and federal guidance have incorporated equity considerations for many decades, improving equitable outcomes from federal investments has been a focus of the Biden Administration. *Equity* is defined in multiple EOs as “the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment” (EO 13985, 2021). This report is intended to inform USACE, the Engineering With Nature® program (EWN), and other federal and local partners as they implement guidance and EOs from the Biden Administration directing agencies to directly consider and address challenges of inequity in grantmaking and investment programs.

Much of the federal environmental justice (EJ) guidance focuses on terminology from EO 12898, related to avoiding “disproportionately high and adverse human health or environmental effects on minority populations and low-income populations,” (1994). Other federal guidelines emphasize the need for “fair treatment and meaningful involvement” of these populations in the development, implementation, and enforcement of environmental laws, regulations, and policies (Kuehn, 2000; National Academies Press, 1999). Additionally, EO 14008 requires that agencies take steps to ensure that 40% of federal investment benefits flow to disadvantaged communities (2021). This recent guidance emphasizes establishing benefits in addition to demonstrating that the federal government is attempting to avoid harm. Given this broadening view, federal agencies seeking to identify and address the EJ impacts of their actions must necessarily take a multi-tiered approach, including examining distributional and procedural equity. As specific guidance for multi-dimensional equity analyses does not currently exist, analyzing each of these EJ taxonomies requires a distinct set of analytical tools.

To demonstrate and examine the relative merits of emerging methods to quantify equity, the authors of this research study (hereafter, “the study team”) used historic USACE projects, tailoring this research to USACE’s project planning constraints and policies. Using a retrospective case study analysis to test several analytical tools in service of assessing multiple dimensions of equity, the case studies used in this study were selected for a previous report (Fischbach, Dalyander, McHugh, et al., 2023) that tested methods of benefit quantification and monetization for natural and nature-based features (NNBFs) of USACE projects. The study team elected to use these same case studies for this analysis so as to build on the previously recalculated benefit-cost analyses. There are inherent limitations to a retrospective analysis, including that the laws, guidance, and policies were not all uniform when the original studies



were completed. This study provides an opportunity to explore how modern tools and methods can enhance project outcomes, ensuring future feasibility studies align with evolving policy requirements.

Six case studies were examined for this report:

- South San Francisco Bay (CA)
- West Sacramento (CA)
- South Platte River and Tributaries (CO)
- Southwest Coastal Louisiana (LA)
- Jamaica Bay: Hudson-Raritan Estuary (NY)
- Jamaica Bay: Hurricane Sandy General Reevaluation Report (NY)

For each case study, the study team performed the following analyses.

PROCEDURAL EQUITY

Procedural equity is an approach to equity that focuses on making sure that agency processes are fair. Procedural equity is “inclusive, accessible, authentic engagement and representation in processes to develop or implement programs and policies,” (Park, 2014). For the procedural equity analyses, the study team considered stakeholder engagement and reviewed public comments to determine the extent to which communities impacted by USACE’s proposed projects and plans were meaningfully engaged throughout plan development.

In analyzing procedural equity, the study team realized the importance of understanding the demographic characteristics of a study area at the most granular scale possible (census blocks or block groups) to tailor engagement strategies to the specific study area and ensure that public engagement is representative of those potentially impacted by a project. The study team also determined the value of tracking traditionally qualitative engagement data to measure the effectiveness of project outreach efforts and better integrate public input into tradeoff analyses and alternative selection before selecting a final set of alternatives.

DISTRIBUTIONAL EQUITY

Distributional equity, which is based on the distribution of material resources as well as decision-making authority and capacity, is when “policies and programs result in fair distributions of benefits and burdens across all segments of a community,” (Park, 2014).

To explore how USACE could more effectively account for distributional equity, the study team delineated the affected environment of each study area, identified and interpolated the affected populations, and conducted geostatistical analysis to evaluate potential impacts.

The study team concluded that the scale of an analysis impacts the accuracy of its outcomes. Using the smallest geographic census units available for each part of this analysis provided a level of granularity necessary for federal projects that impact many people. Applying a dasymetric mapping process to create population-weighted centroids also increased the accuracy of this analysis by allowing the study team to correct for edge effects near the delineated study area boundaries.



The study team also realized the value of using odds ratios to provide a level of comparability across population characteristics when assessing potential disproportionate impacts. The study team also determined that the delineation of buffers to determine a potential benefit or impact area is perhaps one of the most consequential decisions that can be made at the beginning of a feasibility study process. How it happens, the time in which it happens, and who is involved will significantly impact the analysis, and therefore the outcomes.

ANALYSIS OF EQUITY WEIGHTING IN BENEFIT-COST ANALYSIS

The Biden Administration’s emphasis on modernizing regulatory review (Executive Order No. 14094, 2023) contained significant changes to analytical methods that can be used within agencies to assess the distribution of benefits to disadvantaged communities. The updated Office of Management and Budget (OMB) Circulars A-4 and A-94 expanded guidance for distributional analysis—the impacts of regulatory action across different groups within the population and economy, and across time and space. Circular A-94 states that agencies “should aim at identifying the relevant groups of people who gain and lose from policy decisions” (OMB, 2023b, p. 16) and that using weights based on the diminishing marginal utility of income can help address differential effects.

To test these methods, the study team applied weights to different kinds of benefits, testing how using different reference incomes changed the decision context and result of the weighting exercise. By inflating the monetary value of benefits to those who earn or have less than a reference income and shrinking the value of benefits to those who earn or have more than that same reference income, the weighted benefits better reflect the actual impact of a project on the wellbeing of the people anticipated to benefit from it.

Key findings included that the efficacy of the equity weighting methods depends entirely on the choice of reference income. Because the weights are a mathematical function between the study area and the reference income, the analyst’s or decisionmaker’s priorities and judgement determine the results of the weighting exercise by setting the relationship between the study area and the reference income. For example, a decisionmaker could prioritize equity weighting of benefits within a particular geography, such as a state; this would normalize differences between states and emphasize differences in income within a state. A US median income used as a reference income helps to normalize across housing value disparities, but cannot measure other important factors, such as disparities in housing quality or other factors that might be important for Flood Risk Reduction (FRR) projects.

Equity weighting offers an opportunity to explore larger questions of equity priorities within the Civil Works program. The use of equity weighting could improve the accounting of benefits throughout a project’s lifecycle, including earlier in the planning process and to assess tradeoffs between alternatives, or even to support alternatives development. Further, equity weighting could support benefits accounting for programs like Justice40.

CONSIDERATIONS FOR IMPLEMENTATION

The new draft Agency Specific Procedures (ASPs) for PR&G implementation offer opportunities to enhance collaboration and refine decision making processes at USACE, allowing for more innovative and



equitable project outcomes. For example, the new draft ASPs include several elements that will increase the complexity of required analyses for benefits evaluation, tradeoffs, and community engagement:

- An emphasis on application of multiple methods for benefits evaluation, including monetization, quantification of outcomes through metrics other than dollars, qualitative determination of outcomes.
- Prescribed use of multi-objective analysis to consider tradeoffs across monetized, quantified, and qualified outcomes without weighting based on the method of benefit evaluation, and the continued assessment and updating of these tools and methods.
- An emphasis on procedural equity and EJ, including improving engagement with Tribal Nations and other EJ communities, integrating the NEPA and PR&G processes, and including disproportionate burdens and other EJ factors in evaluation.

In assessing how procedural, distributional, and equity-weighted BCAs could be implemented across different contexts (districts, business lines, individual projects, etc.), it can be useful to evaluate how various pre-project decisions need to be supported by one or more of these types of analyses. Developing and articulating the decision structure—informed by USACE goals—can inform which types and levels of analyses will support a more equitable distribution of benefits more broadly. Considerations may include the level of analysis for which the methods outlined in this report could be used, goal setting around individual projects versus entire portfolios, or whether these methods could be used to compare competing projects. These methods might also help project teams measure progress towards specifically identified targets.

As USACE moves toward implementation of new ASPs (once finalized), there will be opportunities to refine, adjust, and expand project planning processes to accommodate new analyses. Investing in skills and resources like Geographic Information Systems (GIS) analysis, data collection and organization, graphic design and communications, and interactive dashboards that show the complexity of alternatives may be needed. The challenge of incorporating multiple dimensions of equity into project planning can be met with new methods supporting USACE decisions.



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LIST OF ACRONYMS

Acronym	Term
AAEQ	Average Annual Equivalent
ACS	American Community Survey
ADCGIS	Adams and Denver Counties, Colorado General Investigation Study
AEP	Annual Exceedance Probability
ASP	Agency Specific Procedure
BCA	Benefit Cost Analysis
BCR	Benefit Cost Ratio
CAP	Continuing Authorities Program
CEJST	Climate and Economic Justice Screening Tool
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CRP	Comprehensive Restoration Plan
DHHS	Department of Health and Human Services
DOA	Department of Agriculture
DOC	Department of Corrections
DoD	Department of Defense
DOJ	Department of Justice
DOL	Department of Labor
DPC	Domestic Policy Council
DWSC	Deep Water Ship Channel
EA	Environmental Assessment
ED	Department of Education
EIA	Economic Impact Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EJ	Environmental Justice



Acronym	Term
EO	Executive Order
EWN	Engineering with Nature
FAA	Federal Aviation Authority
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
FRM	Flood Risk Management
FRR	Flood Risk Reduction
GDP	Gross Domestic Product
GIS	Geographical information system
GRR	General Reevaluation Report
GSA	General Services Administration
HFFRRF	High Frequency Flood Risk Reduction Feature
HRE	Hudson Raritan Estuary
HSGRR	Hurricane Sandy General Reevaluation Report
HUD	U.S. Department of Housing and Urban Development
IEJ	Institute for Economic Justice
IDM	Intelligent Dasyetric Mapping
IWG	Interagency Working Group
LNG	Liquid natural gas
LPP	Locally Preferred Plan
LULC	Land use land cover
NEC	National Economic Council
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NGO	Non-Governmental Organization
NLCD	National Land Cover Database



Acronym	Term
NNBF	Natural and Nature-Based Feature
NOI	Notice of Intent
NPV	Net Present Value
OIRA	Office of Information and Regulatory Affairs
OMB	Office of Management and Budget
OSE	Other Societal Effects
PEJA	Potential Economic Justice Area
PR&G	Principles, Requirements, and Guidelines
RP	Recommended Plan
SCVWD	Santa Clara Valley Water District
SLR	Sea-Level Rise
TEC	Target Ecosystem Characteristic
UDV	Unit Day Value
USACE	U.S. Army Corps of Engineers
USDOJ	U.S. Department of the Interior
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
WHEJAC	White House Environmental Justice Advisory Council
WPCP	Water Pollution Control Plant
WRDA	Water Resources Development Act



1.0 INTRODUCTION

This report is intended to inform the U.S. Army Corps of Engineers (USACE), the Engineering With Nature® (EWN) program, and other federal and local partners as they implement guidance and executive orders (EOs) from the Biden Administration directing agencies to directly consider and address challenges of inequity in grantmaking and investment programs. Equity is defined in EOs as “the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment” (EO 13985, 2021). Federal investments, including the more than \$650 billion per year in goods and services procured, are a “powerful tool to support small business growth and build generational wealth throughout the United States, including for firms owned by underrepresented individuals” (Office of Management and Budget [OMB], 2021b). These opportunities have not been shared by all Americans, as “entrenched disparities in [the] laws and public policies, and in public and private institutions, have often denied that equal opportunity to individuals and communities” (EO 13985, 2021).

The Biden Administration’s goal of “embedd[ing] a focus on equity into the fabric of Federal policymaking and service delivery” (EO 14091, 2023) requires an evidence-based approach. In light of these commitments to understanding and increasing equity throughout the government, this research study seeks to demonstrate and examine the relative merits of emerging methods to quantify equity, using historic USACE projects and tailored to USACE’s project planning constraints and policies.

The study team approached this research through the following questions:

- How federal environmental policy and planning has accounted for historical and present inequities, by analyzing the history of the Environmental Justice (EJ) movement related to addressing disproportionate burdens;
- How recent initiatives from the Biden Administration have expanded this focus on disproportionate burdens to include the fair and equitable distribution of benefits to disadvantaged communities; and
- How current methods, guidance, and assessments could account for different dimensions of equity, including procedural equity, disproportionate impact, and the equitable distribution of benefits.

This report begins with a literature and policy review that explores equity in environmental and water resources planning, including building a timeline of relevant policy guidance and its impacts across federal agencies (Chapter 2.0). A methods chapter follows, detailing the analytical methods used by the study team that led this research effort for procedural equity, distributional equity, and benefit cost analysis with equity weighting (Chapter 3.0). The study team that led and conducted the research for this effort is largely made up of the same personnel responsible for the collaborative project detailed in Fischbach et al. (2023). The case study results are presented as a series of seven chapters, detailing the results from each of the three equity analyses (Chapter 4.0–9.0). A discussion of cross-cutting themes and the effectiveness of the analytical methods themselves concludes the report (Chapter 10.0–11.0).



2.0 LITERATURE AND POLICY REVIEW

This chapter presents a review of relevant policies and literature to explore equity in planning for water resources and other environmental projects and programs. This review includes tracing the evolution of federal policy approaches to addressing inequities, understanding key terms, reviewing relevant EOs and guidance for federal agencies, examining how case law can impact enforcement of these provisions, reviewing recent updates to federal guidance, and examining how this policy environment specifically impacts the USACE Civil Works mission.

2.1. EVOLUTION OF FEDERAL APPROACHES TO ADDRESSING INEQUITIES

Project planning for environmental and water resources projects, as practiced by the federal government, is impacted by regulatory, legislative, and executive policymaking, including EOs issued by the President, legislation passed by Congress, rulemaking and regulatory initiatives conducted by federal agencies, and other work from interagency coordinating bodies. The justice system also has a role in planning, in that an agency's action or inaction can be challenged in court, and the court's opinion needs to be considered moving forward as case law. The interactions between these policy instruments have contributed to how the federal government understands, measures, and assesses equity in project planning.

2.1.1 White House and Federal Agency Roles

To understand the different policy instruments, their origins, and their functions, it is important to be familiar with the place and function of equity in project planning. EOs are issued by the President, often with an accompanying memorandum that provides guidance to agencies as to how to operationalize the EO. The agencies use this guidance to develop their own plans, policies, and procedures, which can be done through the formal rulemaking process and is subject to public comment. Interagency bodies develop additional guidance documents that help each agency work collaboratively and consistently across agencies and programs. Other roles, such as the Council on Environmental Quality (CEQ), which enforces federal agency obligations to implement the National Environmental Policy Act (NEPA), are developed through statute. Policies are often further defined, limited, structured, or enshrined through case law and judicial decisions, as stakeholders use the court system to test the enforceability of a policy, regulation, or program.

In this federal policy landscape, USACE has an important role in advancing equity through its projects and programs. USACE is the federal government's largest water resources development and management agency, mainly through its Environmental and Civil Works missions. USACE is responsible for river navigation and reducing flood damage, for the building and management of reservoirs, hydroelectric dams; in addition, they provide recreational sites, restore ecosystems, and regulate the construction activities in wetland and aquatic environments across the country. This role has evolved and expanded over time, from an early focus on navigation to an expanding environmental stewardship role balanced with economic development. USACE's authority is defined in statute, including laws like the Rivers and Harbors Act (1899), the Clean Water Act (1972), the Flood Control Act, and the repeated authorizations of the Water Resources Development Act, or WRDA, most recently in 2022. As part of the Army, USACE is subject to implementation guidance for EOs from the Department of Defense (DoD).



2.1.2 Recent History from Environmental Justice to Justice40

The Biden Administration is currently focused on changing the distribution of benefits from projects, programs, and other federal spending to “disadvantaged communities that are marginalized by underinvestment and overburdened by pollution,” as typified by the Justice40 initiative, which is described further in Section 2.2.3 (The White House, 2024). While equity is currently a focus of the Biden Administration, many legacy programs, projects, and missions of federal agencies impacted by these EOs have incorporated equity considerations for many decades, such as the New Deal and earlier efforts to benefit society as a whole by bringing infrastructure to areas in need of development. Efforts to incorporate equity into federal investment are important in part because these investments can be durable when legislatively authorized; for example, the Rural Electrification Act of 1936, which created rural electricity cooperatives, is still in effect, and provided a framework that resulted in an additional \$11 billion in rural electrification investment from the Inflation Reduction Act (USDA, 2023). The Flood Control Acts, passed in response to the Great Mississippi Flood of 1927, authorized USACE to design and construct levees and other flood control structures, and committed the federal government to protecting people and property, a mission which endures today.

The U.S. Environmental Protection Agency (USEPA) was established in 1970 as President Nixon signed NEPA, marking a turning point in federal action on environmental quality after years of public pressure during the 1960s. NEPA requires federal agencies to assess the environmental effects of their proposed actions prior to making decisions, and provide opportunities for public review and comment. Subsequently, protests and legal action by communities over the siting of landfills in Black communities, including the *Bean v. Southwestern Waste Management Corporation* decision in 1979 and the Warren County, North Carolina movement against a toxic landfill, formalized the EJ movement and its focus on avoiding disproportionate harms (Bullard, 2000). Over time, this led to additional federal action in the form of the Environmental Equity Workgroup in 1990 and the National Environmental Justice Advisory Council in 1993. The U.S. Commission on Civil Rights cites previous USEPA Administrators for a definition of EJ as “the fair treatment of all races, income, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies, and their meaningful involvement in the decision-making processes of the government” (U.S. Commission on Civil Rights, 2003). President Clinton’s EO 12898 established the Interagency Working Group on Environmental Justice (IWG on EJ), and many agencies’ policies and procedures today, especially those related to procedural equity and community involvement, are still influenced by the policies set forth in EO 12898 (EO 12898, 1994). Additional EOs from President George W. Bush, such as EO 13352 to facilitate cooperative conservation policies, and President Biden have further extended the focus on equity to include additional dimensions of procedural equity, distributional equity, and the application of these dimensions to federal agencies tackling the climate crisis.

The focus of these environmental policy and planning tools has evolved from avoiding disproportionate harms, to improving procedural equity by increasing community involvement, to the current focus on distributional equity and benefits. Figure 2-1 offers a timeline of some of these milestones, which will be described further in Section 2.2.

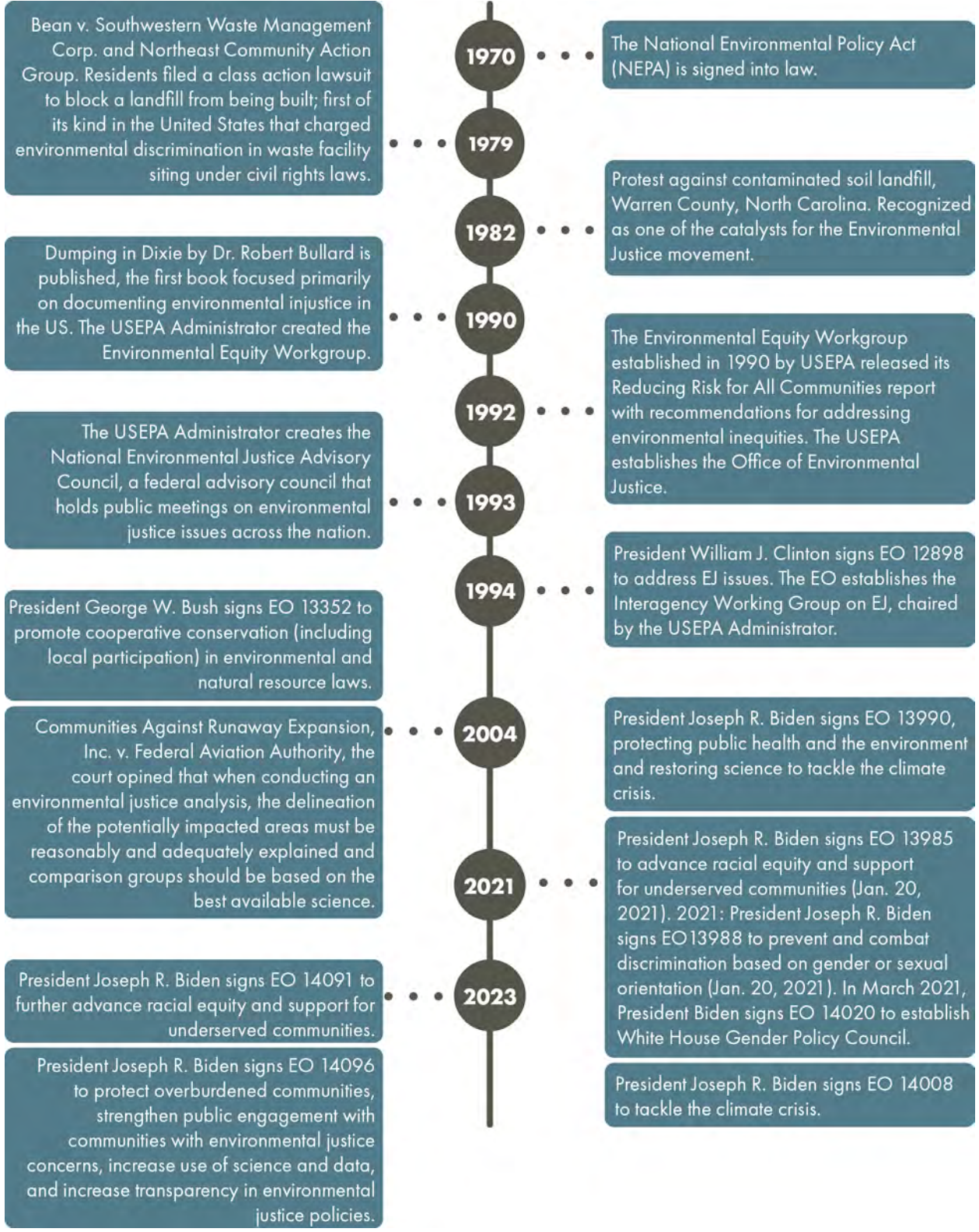


Figure 2-1. Timeline of selected environmental justice milestones.



In 1994, President Clinton required that each federal agency develop agency-wide strategies to identify and address any “disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations” (EO 12898, 1994). This initial federal definition of EJ focuses not only on disproportionate burdens, but also on the enforcement of environmental laws and opportunities for public participation. Minorities and low-income populations are identified in this definition as the groups who have been subject to, and are entitled to relief from, unfair or unequal treatment. Lastly, this definition refers to EJ as a goal or aspiration to be achieved, rather than as a problem or cause (Kuehn, 2000).

In 1998, the USEPA Office of Environmental Justice expanded the federal EJ definition as

“The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no population, due to policy or economic disempowerment, is forced to bear a disproportionate share of the negative human health or environmental impacts of pollution or environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local and tribal programs and policies”.

(Kuehn, 2000; National Academies Press, 1999)

Other federal agencies, including the Department of Housing and Urban Development (HUD), United States Department of Transportation (USDOT), United States Department of the Interior (USDOJ), and USACE, provide their own definitions of EJ (Table 2-1).

Table 2-1. Summary of US federal agency definitions of EJ.

Agency	Definition	Source
HUD	“EJ entails the achievement of HUD’s statutory purposes by providing decent, safe, sanitary, and affordable housing vital to communities in a manner that does not impose disproportionate adverse environmental or health effects on minority and low-income communities.”	HUD, 2016
USDOT	“[T]he fair treatment and meaningful involvement of all people, regardless of race, ethnicity, income, national origin, or educational level with respect to the development, implementation and enforcement of environmental laws, regulations and policies. DOT is committed to ensuring a fast, safe, efficient, accessible, and convenient transportation system for communities nationwide.”	USDOT, 2016
USDOJ	“[M]eeting the needs of underserved communities by reducing disparate environmental burdens, removing barriers to participation in decision making, and increasing access to environmental benefits that help make all communities safe, vibrant, and healthy places to live and work.”	USDOJ, 2020
USACE	“[T]he fair treatment and meaningful involvement of all people regardless of race, color, national origin or income regarding the development, implementation and enforcement of environmental laws, regulations, and policies, with no group bearing a disproportionate burden of environmental harms and risks.”	Conner, 2022



These definitions show that from an agency perspective, EJ broadly refers to the degree to which low income and minority residents are or may be disproportionately impacted by environmental risks and hazards. By establishing the concept of disproportionate impact as integral in its definition of EJ, the assessment of environmental equity is the primary tool for agencies to assess the EJ impacts of their actions. Achieving environmental equity can be considered the primary goal of federal policy, while EJ refers to federal actions taken to identify and address potential environmental inequities.

In 1992, prior to the release of EO 12898, the USEPA defined environmental equity as “the equitable distribution of environmental risks across population groups” and used the term to refer to the EJ phenomenon (Kuehn, 2000; USEPA, 1992). Environmental equity, as initially defined by the USEPA, “impli[ed] the redistribution of risk across racial and economic groups rather than risk reduction and avoidance” (Kuehn, 2000) Current legal and policy usage of the term environmental equity refers to “the equitable sharing of environmental impacts by a community. Environmental policies and laws seek to ensure that no one group or community bears a larger, unfair share of harmful effects from pollution or environmental hazards” (Black’s Law Dictionary, n.d.).

2.1.3 Defining Equity and Other Key Terms

The terms in this section describe ways to integrate environmental equity into processes and functions. Beyond the distribution of risks and harms, these subtypes or dimensions of equity also relate to the distribution of benefits and resources.

Distributional Equity: This dimension of equity looks at the distribution of material resources as well as decision-making authority and capacity. It also examines the distribution of harms, as in the origin of the EJ movement itself; Mendez-Barrientos et al. note that “distributive justice has been widely held as the central dimension of EJ scholarship” (2024). Distributional equity is when “policies and programs result in fair distributions of benefits and burdens across all segments of a community, prioritizing those with the greatest needs” (Park, 2014). This focus on proportional outcomes or impacts of an intervention is seen as “the most resource-intensive to assess, and therefore the least measured” (Junod et al., 2021).

Procedural Equity: This approach to equity focuses on processes and making sure that agency processes are fair. Procedural equity is “inclusive, accessible, authentic engagement and representation in processes to develop or implement programs and policies” (Park, 2014). Bullard defines procedural equity as “the extent that governing rules, regulations, evaluation criteria, and enforcement are applied uniformly and in a nondiscriminatory way” (Bullard, 2001). This dimension of equity is not as materially represented within benefit cost analyses (BCAs), other than in assessments of methods and findings (Junod et al., 2021). In practice, as articulated by Sherry Arnstein, procedural equity “can devolve to tokenism or perfunctory input” (Junod et al., 2021; Arnstein, 1969).

Structural Equity: Structural equity focuses on the institutional or organizational structures and incentives that perpetuate inequity and changing those structures. Structural equity is achieved when “decisions are made with a recognition of the historical, cultural, and institutional dynamics and structures that have routinely advantaged privileged groups in society and resulted in chronic, cumulative disadvantage for subordinated groups” (Park, 2014).



Recognitional Equity: Recognitional equity “refers to addressing the psychological, emotional, and cultural needs of the systematically marginalized where bias and disadvantage are embedded or evident” (Bozeman et al., 2022). In planning literature, this dimension of equity entails “acknowledging community members’ different intersecting identities, recognizing that these identities are shaped by historical injustices and can shape individual vulnerability [...], and fostering respect for different groups” (Meerow et al., 2019). Acknowledgement and collaboration to develop and utilize traditional ecological knowledge (TEK) with Tribal Nations and Indigenous communities is one example of recognitional equity in environmental science (Finn et al., 2017).

There are other terms that are often interchangeably used with EJ but are distinctly different in their meaning.

Climate Justice: Climate justice emphasizes equitable distribution and mitigation of climate change impacts. This concept recognizes that those least responsible for climate change will experience the greatest adverse impacts and have the least capacity to adapt (Office of the United Nations High Commissioner for Human Rights, 2019). Climate justice is “about paying attention to how climate change impacts people differently, unevenly, and disproportionately, as well as redressing the resultant injustices in fair and equitable ways” (Sultana, 2022). In addition to containing elements of distributional equity, climate justice also incorporates procedural equity in its focus on fairness and transparency in environmental decision making.

Environmental Racism: Environmental racism is a term that broadly encapsulates racial discrimination in environmental policy making and in the enforcement of related regulations and laws resulting in: 1) the deliberate targeting of communities of color for toxic waste facilities; 2) the official sanctioning of the life-threatening poisons and pollutants in minority communities and communities of color; and 3) exclusion of people of color from leadership in environmental/ecological movements (Bullard, 2000).

There is disagreement over the proper usage of this term, particularly regarding whether an action having an unequal distributive outcome across racial groups would in itself be a sufficient basis on which to consider an action as environmental racism or whether the action must be the result of intentional racial animus (Evans, 1998; Foster, 1993; Kuehn, 2000; Torres, 1992). EJ advocates and scholars often avoid this term, though the phrase continues to be employed and can be useful in identifying the institutional causes of some environmental injustices (Kuehn, 2000).

Social Vulnerability: While EJ and social vulnerability are related, they represent two distinct concepts. Whereas EJ is specifically focused on the impacts of environmental risks and hazards on low income and minority populations, social vulnerability broadly refers to the inherent characteristics of a person or group (including low income and minority individuals) that influences their capacity to anticipate, cope with, resist, or recover from the impact of a hazard. These characteristics can include social, economic, demographic, and housing characteristics (Baker et al., 2016). A socially vulnerable population is also described as one that is at greater risk due to its individual, social and cultural characteristics relative to the larger population (Baker et al., 2016). Other socially vulnerable groups include children, the elderly, and the disabled. Adger notes that vulnerability is influenced “by the build up or erosion of the elements of socio-ecological resilience: the ability to absorb the shocks, the autonomy of self-organization and the ability to adapt both in advance and in reaction to shocks” (Adger, 2006). This is because vulnerability



can be characterized as the “degree to which a system is susceptible to and is unable to cope with adverse effects” (Adger, 2006). The notion of disproportionate sensitivity to shocks and stresses is thus the defining nature of social vulnerability.

The concept and the associated measurement methods of social vulnerability facilitate compliance with EO 12898 and as such is included as one of the “Other Social Effects” (OSE) expressed in USACE Planning Guidance.

Other Social Effects (OSE): OSE is a term used in federal water resources planning guidance to refer to “how the constituents of life that influence personal and group definitions of satisfaction, well-being, and happiness, are affected by some water resources condition or proposed intervention” (Dunning & Durden, 2009). OSE is specific to water resources planning and thus is most often used by USACE.

The definition of this term encompasses the following factors (Dunning & Durden, 2009):

- Distribution of resources
- The character and richness of personal and community associations
- The social vulnerability and resilience of individuals, groups, and communities
- The ability to participate in systems of governance are all elements that help define well-being and influence to what degree water resources solutions will be judged as complete, effective, acceptable, and fair.

OSE, as both a term and as a concept, has been prevalent in federal regulations since the Flood Control Act of 1936 (Dunning & Durden, 2009). While the 1973 Principles and Standards document notes that “water and land resource plans have beneficial and adverse effects on social well-being,” the document also states that these benefits are “contributions to the equitable distribution of real income and employment,” noting that these effects are “usually not subject to monetary evaluation” (Water Resources Council, 1973). Hurricane Katrina and its aftermath increased awareness for the need to include factors beyond a National Economic Development (NED)-centric model within a collaborative framework that considers OSE factors in project analysis and decision making (Dunning & Durden, 2009). In practice, OSE analysis aids in the identification of OSE factors and in assisting vulnerable populations in participating in the planning process (Baker et al., 2016). The OSE analysis is a detailed process which involves collecting data relevant to social factors connected with specific planning issues (Baker et al., 2016).

The definitions presented in this section represent multiple dimensions of equity and multiple approaches to prioritizing equity within federal policymaking. For this report, the two most relevant concepts are procedural equity and distributional equity. Procedural equity, as a concept, is implemented in policy through both statutes and guidance that outline and define how communities must be consulted throughout a project’s life cycle. Distributional equity is focused on proportionality: ensuring that communities are both shielded from disproportionate harms and that they receive an equitable share of benefits from federal projects and programs. These three concepts—procedural equity, avoidance of disproportionate harm, and equitable sharing of benefits—are the concepts that will be evaluated in the case study reanalysis in Chapters 5.0–9.0 of this report. Recognitional equity, while of increasing interest



and importance in federal policymaking, is not easily quantified and thus is not explicitly analyzed through the case study reanalysis.

2.2. EXECUTIVE ORDERS AND AGENCY GUIDANCE

2.2.1 Executive Order 12898

EO 12898, signed by President Clinton in 1994, provides the impetus for the federal government to address EJ issues and the establishment of executive agency frameworks that follow. EO 12898 applies to federal agencies and executive offices and requires each agency to “make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations” (EO 12898, 1994). Entities covered under EO 12898 include:

- Federal Agencies: Department of Agriculture (USDA), Department of Commerce (DOC), DoD, Department of Energy (DOE), Department of Health and Human Services (DHHS), HUD, USDOJ, Department of Justice (DOJ), Department of Labor (DOL), USDOT, and USEPA
- Executive Office of the President: Office of Management and Budget (OMB), Office of Science and Technology Policy, Office of the Deputy Assistant to the President for Environmental Policy, Office of the Assistant to the President for Domestic Policy, National Economic Council (NEC), and Council of Economic Advisers

In implementing EO 12898, an IWG on EJ was created with the purpose of developing agency-specific EJ strategies. Agency responsibilities and requirements related to EO 12898 include the following areas (EO 12898, 1994):

- Human Health and Environmental Research and Analysis
- Consideration of Subsistence Consumption of Fish and Wildlife—includes data collection, maintenance, and analysis of information on the consumption patterns of fish and wildlife and is relevant to cultural patterns related to food consumption (especially Native food resources). This also includes publishing of guidance documents “reflecting the latest scientific information available concerning methods for evaluating the human health risks associated with the consumption of pollutant-bearing fish or wildlife” (EO 12898, 1994) and considering such guidance in the development of federal policies and rules.
- Public participation and access to information—“Each Federal agency shall provide opportunities for community input in the NEPA process.”
- Consistency with EO 12250-Leadership and Coordination of Nondiscrimination Laws
- Costs and judicial review
- Oversight by CEQ.

EO 12898 specifies that implementation is to occur “whenever practicable and appropriate” (EO 12898, 1994), allowing for agency-level discretion, which has since been updated.



2.2.1.1 Guidance for Agencies

Concurrent with the issuance of EO 12898, President Clinton issued a memorandum, *Executive Order on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, to the heads of all federal departments and agencies to highlight ways that existing environmental and civil rights statutes provide opportunities to address EJ issues (The White House, 1994). This memorandum identified NEPA as an important tool that agencies can use to address potential significant and adverse environmental effects of proposed federal actions on minority and low-income communities. Specifically, federal departments and agencies were directed to incorporate EJ considerations into their environmental assessment (EA), environmental impact statement (EIS), and record of decision procedures.

Additionally, this memorandum called on federal agencies to provide opportunities for low-income and minority communities to have meaningful input in the NEPA process: “Each Federal agency shall provide opportunities for community input in the NEPA process, including identifying potential effects and mitigation measures in consultation with affected communities and improving the accessibility of meetings, crucial documents, and notices” (The White House, 1994).

To implement EO 12898, this memorandum called for the development of agency-specific EJ strategies that should list programs, policies, planning and public participation processes, enforcement, and rulemakings related to human health and the environment. The EO states the requirement to develop these strategies but provides federal agencies with autonomy to determine how best to implement its orders. Therefore, each agency determines its own process in alignment with its goals/objectives, while still adhering to those outlined by the EO.

2.2.1.2 Guidance from Council on Environmental Quality and Implementation by the Department of Defense

Coordination between federal agencies is written into the text of EO 12898. To operationalize this coordination, CEQ was given oversight of federal department and agency compliance with EO 12898 in their NEPA processes. In 1997, CEQ issued a guidance document, *Environmental Justice: Guidance Under the National Environmental Policy Act*, to assist federal agencies with their NEPA procedures in an effort to ensure that EJ concerns are effectively identified and addressed (CEQ, 1997). While CEQ provided general guidance and oversight to federal agencies, it also allowed for agencies to supplement this guidance with specific procedures tailored to their programs and activities.

In its *Strategy on Environmental Justice*, the DoD noted that it would implement EO 12898 principally through its compliance with the provisions of NEPA (DoD, 1995). In this strategy, the DoD recognized that a mixed-method approach would be needed to identify EJ communities, highlighting the need to strengthen its community relations plan to assist the department in understanding the socioeconomic makeup of the populations in and around its projects and operations. As part of this process, the department recognized the need to “combine data gathered from interviews with members of the local community with information gathered from the U.S. Census Bureau and various databases maintained by the military departments, defense agencies, and other agencies such as the USEPA and local and tribal governments” (DoD, 1995). It is also stated that where this information does not exist, the DoD will coordinate with other federal, state, local, and tribal governments to develop the data.



2.2.1.3 Methodological Guidance for Federal Agencies

While EO 12898 and the subsequent strategy and guidance documents are prescriptive, they generally do not provide methodological guidance for federal agencies. For example, when conducting a NEPA review, 40 CFR 1508.7 and 40 CFR 1508.8 require that agencies assess the direct, indirect, and cumulative impacts of a project on low income and minority populations (40 CFR 1508, n.d.). However, the specific methods and techniques required to conduct a legal, scientifically defensible assessment are not provided.

In 2006, the USEPA document *Toolkit for Assessing Potential Allegations of Environmental Justice* outlined a systematic approach to EJ with references to tools that can be used and adapted to assess and respond to potential allegations of environmental injustice as they occur, or to prevent injustices from occurring (USEPA, 2006). This document presents a series of EJ indicators, such as environmental (sources of stress, potential exposure, or vulnerability) and health (existing conditions, impacts from environmental stressors) that can be used to assess the potential impacts of environmental decisions and then outlines a systematic approach for using these indicators to assess EJ concerns.

Historically, federal agencies have tended to focus on ecological and health impacts of environmental actions. USEPA notes that such a focus may not consider the cumulative and synergistic impacts of multiple stressors on low-income and minority populations. Further, traditional impact assessments often do not examine the impact of environmental action on quality of life and other factors such as aesthetic, cultural, social, and economic impacts of an action on nearby communities. Nor do they examine the pre-existing illness and disease rates in a community. However, many of these factors must be considered by federal agencies in accordance with NEPA (USEPA, 2006).

In 2016, the IWG on EJ & NEPA Committee produced a guidance document titled *Promising Practices for Environmental Justice Methodologies in NEPA Reviews*. While this document does not provide formal guidance, it does offer federal agencies with recommendations for conducting EJ analyses for NEPA reviews. The authors note that while “each section of the document has been arranged to loosely mirror a linear progression, in actual practice, these steps are often overlapping and interrelated” (IWG on EJ & NEPA Committee, 2016). The steps include:

- meaningful engagement,
- the scoping process,
- defining the affected environment,
- developing and selecting alternatives,
- identifying minority populations,
- identifying low-income populations,
- the impacts analysis,
- disproportionately high and adverse impacts, and
- mitigation and monitoring.



Meaningful engagement is primarily concerned with disseminating and receiving information from the affected community. This category includes USEPA guidance to ensure that agencies seek out and facilitate involvement from potentially affected populations by providing an appropriate opportunity to participate and influence decisions for a proposed activity that will affect their environment and/or health. One opportunity for incorporating meaningful engagement is through the scoping process, which should include one or more public meetings organized by the agency that allow the public an opportunity to offer ideas and information regarding issues and impacts (including those related to EJ) that the environmental review process should include, as well as offer additional alternatives to be evaluated by the agency. This phase also provides agencies an opportunity to inform the public of project schedules, additional commenting opportunities and deadlines, and points of contact.

The **scoping process** allows federal agencies to better understand how minority populations and low-income populations may be affected, or what vulnerabilities may exist from multiple impacts occurring to one or more environmental resources.

There are a variety of methods for **identifying minority and low-income populations**. The Appendix to CEQ's 1997 EJ Guidance: *Appendix: Guidance for Agencies on Key Terms in Executive Order 12898* (IWG on EJ & NEPA Committee, 2016) provides threshold tests for identifying minority populations, including the no-threshold analysis (i.e., identifies all minority populations regardless of size), the fifty-percent analysis (i.e., more than half of potentially affected persons are defined as minorities), and the meaningfully greater analysis (i.e., a percentage threshold is established to identify a "meaningfully greater" minority population in the affected area).

Low-income populations can similarly be identified using threshold tests, including those provided by the annual statistical poverty thresholds from the U.S. Census Bureau's *Income and Poverty in the United States: Current Population Reports* series, as well as utilizing the alternative criteria analysis (i.e., the agency first chooses the official poverty level threshold that it will use), or the low-income threshold criteria analysis (i.e., identifies the number and percentage of low-income households in each geographic unit and finds a reference community [e.g., county, state] with which to compare the affected communities). Though useful, these threshold tests may not always capture the relevant information needed to identify minority and low-income populations for purposes of EJ analysis, so supplementing the most recent decennial census or American Community Survey data provided by the U.S. Census Bureau with other state and local datasets and community input is recommended.

The **developing and selecting alternatives** step suggests that agencies should encourage community members who may suffer disproportionately high and adverse human health or environmental effect as a result of the proposed action to provide information that agencies can examine for identifying potential alternatives to mitigate these adverse impacts. However, this suggestion places the burden of identifying EJ communities on the potentially affected populations themselves and assumes that they have either previously self-identified as EJ communities in an earlier step or that outreach occurred in prior steps to meaningfully engage these communities.

The **impacts analysis** category offers definitions from 40 CFR 1508.7 and 1508.8 when considering direct, indirect, and cumulative impacts. Direct and indirect impacts are defined as those caused by the action but differ in that direct impacts occur at the same time and place as the action, while indirect



impacts occur later in time, and are reasonably foreseeable results of the action. Cumulative impacts result from incremental impacts of the action over a period of time that may be individually minor, but collectively significant. If the impacts identified in the analysis are not significant or can be mitigated to a level that is no longer significant, an EA/Finding of No Significant Impact (FONSI) can be issued.

Disproportionately high and adverse impacts are determined based on the impacts identified by one or more resource topics analyzed in NEPA documents. Guidance for informing an agency's determination of disproportionately high and adverse impacts includes evaluating for context and intensity, as well as considering factors that may amplify the impact of the proposed action to minority and low-income populations. This guidance also offers two approaches to determine disproportionately high and adverse impacts: the impact focus approach and the balancing approach. The impact focus approach considers the distribution of adverse and beneficial impacts to low-income and minority populations compared to the general population in the affected environment and analyzes mitigation measures for reducing negative impacts.

The balancing approach focuses on steps the agency can take to reduce impacts on low-income and minority populations, how to balance any remaining negative impacts with additional benefits and relate the beneficial impacts and mitigation measures to the type and location of the adverse impact. For both approaches, if any negative impacts remain upon completion of the analysis of benefits and mitigation measures, agencies must determine whether any remaining impacts are disproportionately high and adverse. If they are, agencies are encouraged to consider appropriate alternatives to the action and additional mitigation and monitoring measures and engage the potentially affected communities to determine their preferences.

The final step is **mitigation and monitoring**. Agencies are encouraged to consider methods to clearly identify and analyze mitigation measures for impacts to low-income and minority populations in the affected environment, develop mitigation measures in consultation with the community, and include mitigation activities in NEPA documents and explain how measures will be implemented and tracked. IWG on EJ & NEPA Committee (2016) also highlights CEQ's *Guidance on Appropriate Use of Mitigation and Monitoring* as a resource for evaluating mitigation measures over time to ensure they are performing as projected (CEQ, 2011).

Many federal efforts to address environmental justice in the NEPA process utilized a combination of methods derived primarily from three sources; CEQ's *Environmental Justice Guidance under the National Environmental Policy Act* released in December 1997, the Department of Defense's 1995 release of *Strategy on Environmental Justice* and USEPA's *Promising Practices for EJ Methodologies in NEPA Reviews* established in March 2016. Each of these federal guidance and strategy documents have been used in combination by federal agencies, including USACE, to address EJ as required under EO 12898.

2.2.2 Executive Orders 13985 and 14091

EO 13985, signed by President Biden on January 20, 2021, directed the federal government to pursue a comprehensive approach to advancing equity for all. The order defines equity as "the consistent and systematic fair, just, and impartial treatment of all individuals, including:



- individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color;
- members of religious minorities;
- lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons;
- persons with disabilities;
- persons who live in rural areas; and
- persons otherwise “adversely affected by persistent poverty or inequality” (EO 13985, 2021).

EO 13895 and the subsequent EO 14091 are intended to create opportunities for the improvement of communities through a systematic approach within the federal government. Both EOs lay out guidance “for executive departments and agencies to recognize and work to redress inequities in their policies and programs that serve as barriers to equal opportunity” (EO 13985, 2021; EO 14091, 2023). EO 13895 directs agencies to conduct an internal assessment to determine whether, and to what extent, its programs and policies perpetuate systemic barriers to opportunities and benefits for people of color and other underserved groups. The initial assessments were conducted for agencies to understand how they could develop or improve policies and programs that deliver resources and benefits equitably for all (EO 13985, 2021).

EO 14091 acknowledges “achieving racial equity and support for underserved communities is not a one-time project” and equity must remain the responsibility of agencies across the federal government (EO 14091, 2023). EO 14091 moves beyond the first assessment efforts of EO 13895 and operationalizes an equity focused government. Each agency was required to create an Agency Equity Team (EO 14091, 2023).

Covered federal agencies include the following: USDA, DOC, DoD, Department of Education (ED), DOE, DHHS, HUD, USDOJ, DOJ, DOL, Department of State, USDOT, Department of Treasury, USEPA, Department of Veteran Affairs, Department of Homeland Security, Small Business Administration, Social Security Administration, General Services Administration, United States Agency for International Development, National Aeronautics and Space Administration, National Science Foundation, and the Office of Personnel Management.

2.2.2.1 Guidance for Agencies

EO 13985 directed federal agencies to conduct a review of policies and programs to assess whether underserved communities and their members face systemic barriers in accessing benefits and opportunities (EO 13985, 2021). These efforts began under the guidance of the Domestic Policy Council (DPC) and OMB to assess how agency “programs and policies perpetuated systemic barriers to opportunity, participated in an ongoing government-wide Equity Learning Community; exercised innovative approaches to stakeholder engagement; and developed evidence-based solutions to advance equity (U.S. General Services Administration, 2023).” The initial efforts by agencies resulted in Equity Action Plans from over 90 federal agencies, as well as 50 independent agencies (U.S. General Services Administration, 2023). The Equity Action Plans document each agency’s “commitment to redress



inequities and to promote equitable outcomes in communities (U.S. General Services Administration, 2023).”

The strategies outlined in individual agency Equity Action Plans were based on EO 13985 Sections 4–7 and the OMB’s report, *Study to Identify Methods to Assess Equity: Report to the President* (OMB, 2021). The strategies are:

- Reducing administrative burdens and simplifying government services,
- Engaging with stakeholders and communities who have been historically excluded from policy-making processes,
- Narrowing wealth gaps through federal contracting and procurement,
- Delivering equity through grantmaking, and
- Building accountability for equity through data collection and reporting (The White House, 2023a).

The study team analyzed the content of select agencies’ Equity Action Plan goals to determine how the strategies identified by the agencies aligned with the overarching strategies listed above. There were five goals, such as building resilience, eliminate the racial homeownership gap, or expand transportation access for underserved communities, that did not correlate directly to an overarching strategy and were classified as not applicable (*Table 2-2*).

Approximately one year after agencies turned in their initial Equity Action Plans, EO 14091 implemented annual agency equity strategies that use “the agency’s policy, budgetary, programmatic, service-delivery, procurement, data-collection processes, grantmaking, public engagement, research and evaluation, and regulatory functions to enable the agency’s mission and service delivery to yield equitable outcomes for all Americans, including underserved communities” (EO 14091, 2023). As of September 2023, agencies are required to submit annual Equity Plans that include actions to advance equity, including under EO 13985, EO 13988 of January 20, 2021, EO 14008, and EO 14020 (EO 14091, 2023).



Table 2-2. Count of select agency Equity Action Plan goals.

Strategy	CEQ	FEMA	HUD	USDA	USDOC	DoD	USDOE	USDOI	USDOTD	USEPA
Reducing administrative burdens and simplifying government services	5			2	1		1			2
Engaging with stakeholders and communities who have been historically excluded from policy-making processes		1	2	3		1	1		1	3
Narrowing wealth gaps through federal contracting and procurement		1	1	1	2	1	1	1	2	1
Delivering equity through grantmaking		1		1	1		1	1		
Building accountability for equity through data collection and reporting					2	1	1	1		
Other		1	2			2		1	1	
Total Goals	5	4	4	7	6	5	5	4	4	6

2.2.2.2 Implementation by the Department of Defense

The DoD submitted an Equity Action Plan, but USACE did not submit a separate plan (DoD, 2022). All agencies reviewed, with the exception of CEQ, and set goals to improve access to the federal contracting and procurement process for minority and marginalized businesses and contractors. USEPA and CEQ, who provide guidance to other agencies on NEPA compliance, both outlined specific steps to improve, clarify, and streamline the NEPA process. Seven of the ten agencies identified multiple instances in which the agency could ensure engagement is occurring with stakeholders and communities who have been historically excluded from policymaking.

The DoD identified three goals that aligned with the strategies above, which are:

“Increase economic opportunities for small business, including businesses from underserved communities, and expand contracting with entities employing individuals with disabilities, including under the AbilityOne Program; address the safe and ethical use of AI technology and leading innovation in the use of this technology; and invest in underserved communities and expand access to Department programs and opportunities.” (DoD, 2022)

In two additional goals, DoD identified actions pertaining to advancing equity for military families and “addressing past harms resulting from environmental and other impacts from defense activities on communities around military installations and bases (DoD, 2022).” The communities in the second goal



specifically mentions include Native American lands, Alaska Native Claims Settlement-conveyed properties, ancestral lands, and reserved treaty rights areas (DoD, 2022).

Annually DoD, supported by USACE and other respective departments, will need to update OMB on the following:

“an update on the progress made by the agency on the actions, performance measures, and milestones highlighted in the preceding year’s Equity Action Plan, as well as the agency’s performance on the annual Environmental Justice Scorecard¹ established pursuant to section 223 of Executive Order 14008, as applicable; potential barriers that underserved communities may face in accessing and benefitting from the agency’s policies, programs, and activities, including procurement, contracting, and grant opportunities; strategies, including new or revised policies and programs, to address the barriers described in subsection (b)(ii) of this section and to ensure equitable access and opportunity for underserved communities; and a description of how the agency intends to meaningfully engage with underserved communities, including through accessible, culturally and linguistically appropriate outreach, and the incorporation of the perspectives of those with lived experiences into agency policies, programs, and activities.” (EO 14091, 2023)

2.2.3 Executive Order 14008

Executive actions, including EO 14008 and 14096, have required federal agencies and departments to expand upon established environmental justice methodologies and consider not only the disproportionality of adverse impacts but also the distribution of benefits. On January 27, 2021, President Biden signed EO 14008 “Tackling the Climate Crisis at Home and Abroad.” It represents a significant update to EO 12898 and the federal government’s efforts to address EJ. One of the most consequential changes to how federal agencies and departments address EJ is found in Section 223 of EO 14008, titled the “Justice40 Initiative,” which establishes that 40% of federal investment benefits flow to disadvantaged communities. This recent guidance has incorporated additional foci on establishing benefits in addition to showing that the federal government is attempting to avoid harm.

Two distinct but interrelated bodies were created through EO 14008. The first, the White House Environmental Justice Interagency Council, replaced the previous IWG on EJ (established in EO 12898). EO 14008 required this new Interagency Council to create recommendations for updating EO 12898 within 120 days of issuance (of EO 14008). The second body, the White House Environmental Justice Advisory Council or WHEJAC, was created to independently advise the Interagency Council and the Chair of the White House CEQ. The WHEJAC made several recommendations for revisions to the language of EO 12898 (WHEJAC, 2021). Some revisions were adopted in EO 14008 while others were revised in EO 14096, signed in April 2023.

¹ The scorecard is available online at <https://ejscorecard.geoplatform.gov/scorecard/u.s.-army-corps-of-engineers/>.



- With regard to human health and environmental research analysis, the agencies must, to the maximum extent permitted by applicable law,
 - “actively encourage and solicit community-based science and Tribal ecological knowledge, and provide communities of color, Tribal indigenous communities, low income communities, and people with disabilities the opportunity for meaningful participation on the development and design of research strategies undertaken pursuant to this Order, recognizing that for some environmental justice communities, cultural practices connect to health outcomes and can be disrupted by environmental effects/outcomes/hazards.”
- For human health and environmental data collection and analysis, the revised language in EO 14008 includes collecting, maintaining, and analyzing “tribal membership” along with other previously collected data. This section also includes the requirement, to the extent permitted by law, to disaggregate by ethnicity and subpopulations and further requires that,
 - “Federal agencies must use this information to determine whether their programs, policies, and activities have disproportionate adverse human health or environmental effects on populations of color, Tribal and indigenous populations, and low-income populations.”
- With regard to subsistence consumption of fish and wildlife, there is now the requirement, to the maximum extent permitted by applicable law, to collect, maintain, and analyze information on *subsistence consumption patterns and cultural practices of environmental justice communities.*” (The text in italics indicates revisions to EO 12898 proposed by WHEJAC that were adopted in EO 14008.)
- The following relevant addition was added for Public Participation and Access to Information:
 - “translate *and interpret* public documents, notices, and hearings relating to *an action of the Federal agency as appropriate for the affected population, specifically in any case in which a population with LEP may be disproportionately affected by that action.*”

2.2.3.1 Guidance for Agencies

In addition to the agency guidance developed by WHEJAC, EO 14008 directed CEQ to develop a geospatial mapping tool to identify disadvantaged communities. This tool, the Climate and Economic Justice Screening Tool (CEJST), uses publicly available, nationally consistent datasets to identify disadvantaged communities and identify burdens related to climate change, the environment, public health, and economic opportunity (CEQ, 2023a). The EO requires that federal agencies use CEJST to identify geographically defined disadvantaged communities for any covered programs under the Justice40 Initiative and for programs where a statute directs resources to disadvantaged communities, to the maximum extent possible and permitted by law. Additional guidance issued by OMB sets out the definition of covered programs, initial reporting requirements, and suggested program modifications to maximize benefits (OMB, 2021a).



2.2.3.2 Implementation by the Department of Defense

In March 2023, the Assistant Secretary of the Army for Civil Works issued implementation guidance for Section 160 of WRDA 2020, which defined an economically disadvantaged community. The guidance states that one or more of the following criteria must be met: a per capita income of 80% or less of the national average, an unemployment rate at least 1% greater than the national average, Indian country as defined in 18 U.S.C. 1151 or an Alaska Native Village, a U.S. territory, or a community identified by CEJST. (USACE, 2023a).

A recent USACE EJ guide in support of EO 14008 implementation specifically states that it is insufficient to rely solely on geospatial tools such as CEJST to identify disadvantaged communities, noting that it is important to ground truth this geospatial information with local knowledge (Collaboration and Public Participation Center of Expertise, USACE, 2023). This guide suggests that qualitative documentation such as accounts in project reports, records of public meetings, as well as journalistic reports and academic studies may be used to identify environmental justice communities. Likewise, the guide notes that site visits can be extremely useful for assessing “the lay of the land.” Local government and community partners often have valuable insight into which communities have not been adequately engaged in the planning process and have critical environmental justice concerns (Collaboration and Public Participation Center of Expertise, USACE, 2023).

2.2.4 Executive Order 14096

On April 21, 2023, President Biden signed EO 14096, “Executive Order on Revitalizing Our Nation’s Commitment to Environmental Justice for All.” This EO explicitly updates EO 12898, building on the recommendations initially made after the signing of EO 14008 by the WHEJAC and other advisory bodies. EO 14096 expresses the Biden Administration’s commitment to a whole-of-government approach to EJ and directs all executive branch agencies to incorporate EJ into their missions. The EO also addresses disproportionate harms, distribution of benefits, and procedural equity through the following elements:

- Directing agencies to consider “disproportionate and adverse impacts,” replacing the EO 12898 phrase “disproportionately high and adverse” (The White House, 2023b). These impacts are to include cumulative impacts and burdens of pollution and climate change.
- Directing agencies to actively facilitate meaningful public participation and just treatment of all people in agency decision-making, including Tribal consultation and coordination (The White House, 2023b).
- Charging agencies to develop, implement, and update an EJ strategic plan, which will then be made public through the Environmental Justice Scorecard. This scorecard is intended to include reporting on the progress of the Justice40 initiative, addressing the distribution of benefits (CEQ, n.d.)

2.2.4.1 Guidance for Agencies

In October 2023, CEQ issued a report titled *Strategic Planning to Advance Environmental Justice* which provides guidance to federal agencies on the implementation of EO 14096 (CEQ, 2023b). The EO directs federal agencies to prepare an Environmental Justice Strategic Plan no later than 18 months following the



EO; these plans will be due in November 2024. The CEQ report provides a template for these strategic plans, considerations for developing them, and a planning guide for fulfilling the charges set out in the EO. The guidance is largely focused on the EJ elements of addressing disproportionate harms and fulfilling procedural equity aspirations set out in EO 14008 and EO 14096.

2.3. CASE LAW REVIEW

This section describes two key areas where case law has further delineated or addressed challenges to the procedures and guidance derived from statutes like NEPA. Case law and judicial decisions are critical for understanding how methods for implementing agency guidance, executive orders, and statutory requirements may be tested. Because project decisions are reliant on these assessment methodologies, entire projects can be overturned by courts because of limited or insufficient assessments. Examining how case law has impacted EJ policy in the past provides guidance for the exploratory methods research used later in this report.

2.3.1 Introduction

Case law can impact how methods are used to assess the environmental impacts of agency programs, projects, and decisions. Although the EO requiring agencies to assess the environmental effects of their actions on EJ communities expressly states that it does not create a private right to judicial review, under EO 12898, § 6-609, 59 Fed. Reg. at 7,632–33, a petitioner may challenge an agency's EJ analysis as arbitrary and capricious under NEPA and the Administrative Procedure Act (APA). An example of an EJ challenge by a community is illustrated in the case *Communities Against Runway Expansion, Inc. v. Federal Aviation Authority*, (*Communities Against Runway Expansion Inc v Federal Aviation Administration, et al.*, 2004). Challenges to agency decisions are often made on technical grounds, with petitioners often claiming that the methodological decisions made are “arbitrary and capricious” rather than grounded in science ((5 U.S.C.A. Section 706(2)(A), 1966; *Harrison County Mississippi v United States Army Corps of Engineers*, 2023). In reviewing the adequacy of the methods used to conduct EJ assessments, the courts have sought to ensure that the analysis and subsequent conclusions are “reasonable and adequately explained.” The following two cases highlight the importance of adequate methods. In the first example, the courts sided with the petitioners, finding that the EJ methods used by the agency were arbitrary and capricious. In the second example, the courts rejected the appeal of the petitioners, finding that the agency’s methods were reasonable and adequately explained.

2.3.2 Focus on Impacted Communities

The following case review is an example of how a court may analyze an assessment of communities affected by project impacts. *Vecinos para el Bienestar de la Comunidad Costera v. Federal Energy Regulatory Commission (FERC)* highlights the discrepancy between federal guidance, which requires agencies to determine the extent of the affected environment, and the technical, scientific methods required in a legally defensible EJ analysis (6 F.4th 1321, 1330; D.C. Cir. 2021).

To assess the EJ impacts of siting three liquified natural gas (LNG) terminals and associated pipelines in the city of Brownsville, Texas, the Commission examined the project's impacts on communities in census block groups within a 2-mile radius of the project site, but not on communities farther afield. The Commission found that all communities within those census blocks were minority or low-income. No. 20-1045 J.A. 564 (Rio Grande terminal and Rio Bravo pipeline system); No. 20-1094 J.A. 691–92 (Texas



terminal). The Commission proceeded to examine “whether any of the Project impacts would disproportionately affect those communities due to factors unique to those populations like inter-related ecological, aesthetic, historical, cultural, economic, social, or health factors.” No. 20-1045 Resp’t’s Br. at 53 (internal quotation marks and alterations omitted; quoting No. 20-1045 J.A. 140–42); see also No. 20-1094 Resp’t’s Br. at 44–45. Finding the answer to be no, the Commission concluded that the Rio Grande terminal and Rio Bravo pipeline system “would not have disproportionate adverse effects on minority and low-income residents in the area,” No. 20-1045 J.A. 566, and that the Texas terminal would have “negligible impacts on environmental justice communities,” No. 20-1094 J.A. 968.

However, Petitioners argued that the Commission's decision to analyze the projects’ impacts on EJ communities only in census blocks within 2 miles of the project sites was arbitrary, given its determination that environmental effects from the projects would extend well beyond 2 miles from the project sites. *Vecinos para el Bienestar de la Comunidad Costera v. FERC*, 6 F.4th 1321, 1330 (D.C. Cir. 2021). The FERC itself stated in their EIS that impacts on air quality from each project could occur within 31 miles (*Vecinos para el Bienestar de la Comunidad Costera v. Federal Energy Regulatory Commission*, 2021). The FERC offered no explanation as to why, in light of that finding, it chose to delineate the area potentially affected by the projects to include only those census blocks within 2 miles of the project sites for the purposes of its EJ analyses. The courts agreed, finding that the FERC offered no “rational connection between the facts found and the decision made,” finding the decision to analyze the projects’ impacts only on communities in census blocks within 2 miles of the project sites to be arbitrary and capricious. As a result, all subsequent findings related to the projects’ impacts on minority and low-income residents were called into question. Thus, federal agencies are encouraged to use, at a minimum, technical, and scientific methods to determine the extent of the affected environment to have a sound EJ analysis.

2.3.3 Focus on Comparison Groups

The federal guidelines under NEPA require that agencies compare impacts to minority and low-income populations in the affected environment with an appropriate comparison group within the affected environment. Study of the case law on this issue can be used as additional guidance on how to appropriately determine comparison groups that meet the NEPA requirements. The finding in the *Communities Against Runway Expansion* case, 355 F.3d at 689, was that “when conducting an environmental justice analysis, an agency's delineation of the area potentially affected by the project must be “reasonable and adequately explained,” and include “a rational connection between the facts found and the decision made,” *id.* at 685 (quoting *State Farm*, 463 U.S. at 43, 103 S.Ct. 2856, 1983).

In this case, the courts found that the methodology used by the FAA was reasonable and adequately explained. The EIS sought to compare the demographics of the population predicted to be affected by any increased noise resulting from the project to the demographics of the population that otherwise might conceivably be affected by noise from the airport. The court found that a comparison population based on a larger geographic area could reasonably be rejected because significant noise impacts are limited to the vicinity of the airport. The findings here held that “the choice among reasonable analytical methodologies is entitled to deference” from the courts. Again, this case highlights the fact that federal guidance establishes the framework for analysis and does not prescribe the use of any specific technical or



scientific tool or method. This case illustrates the need to use the best available science and sound reasoning when choosing comparisons groups under the NEPA requirements.

2.4. RECENT REGULATORY GUIDANCE

The Office of Information and Regulatory Affairs (OIRA), housed within the OMB under the Executive Office of the President, is “the central authority for the review of Executive Branch regulations, approval of Government information collections, establishment of Government statistical practices, and coordination of Federal privacy policy” (OIRA, n.d.). On April 6, 2023, OIRA announced updates to the federal regulatory review process, including new proposed versions of Circulars A-4 and A-94, which were last updated in 2003 and 1992, respectively (Revesz, 2023).

Circular A-4 provides guidance for regulatory analysis, while Circular A-94 provides guidance for benefit-cost analysis for federal programs. These circulars were released in draft form for peer review and public comment, and then subsequently finalized in November 2023. They include significant changes to analytical methods that can be used within agencies to assess the distribution of benefits to disadvantaged communities as part of the Biden Administration’s emphasis on modernizing regulatory review (Executive Order No. 14094, 2023). Because benefit-cost analysis and cost effectiveness analysis are often used in project and programmatic decision-making, these changes in methodology and approach can have implications for which projects are built based on how benefits are quantified. These changes also impact reporting and quantification of benefits for Biden Administration priorities like Justice40.

For example, the new draft circular A-4 recommends that time frames for analysis be long enough to “encompass all the important benefits and costs likely to result from the regulation” (OMB, 2023a, p. 10). This is important for accounting for benefits and costs that are likely to be realized in further decades or in future generations, such as incidence of cancer or birth defects. The circular further recommends that a lower discount rate of 2% be used to discount these benefits; this allows for benefits further in the future, such as from nature-based solutions, to be more fully accounted for in net present value terms. OMB derived this rate from the 30-year average of the yield on 10-year Treasury marketable securities, reflecting a “fair approximation of the social rate of time preference” (OMB, 2023a). When discussing benefits and costs that are difficult to monetize, the circular notes that “when it is not possible to quantify or monetize all the important benefits and costs of a potential regulation, the most advantageous policy will not necessarily be the one with the largest quantified and monetized net-benefit estimate” (OMB, 2023a, p. 44) and illustrates this with examples that include human dignity, civil rights, indigenous cultures, and the safety of young children. These examples have relevance for assessing both potential harms to communities and including a broader variety of benefits from projects, programs, and regulations.

Additionally, the updated circulars expanded guidance for distributional analysis—the impacts of regulatory action across different groups within the population and economy, and across time and space. Circular A-94 states that agencies “should aim at identifying the relevant groups of people who gain and lose from policy decisions” (OMB, 2023b, p. 16) and that using weights based on the diminishing marginal utility of income can help address differential effects. While weighting based on income is recommended, weighting based on other demographic characteristics such as race or gender is not included in this guidance. The difficulties of assessing distributional impacts by race and gender include



aggregation methods and the information burden of weighting further beyond income (Acland & Greenberg, 2022; Revesz & Yi, 2021). Circular A-4 notes that distributional interest may lead an agency “to select a regulatory alternative with lower monetized net benefits over another with higher monetized net benefits because of the difference in how those net benefits are distributed in each alternative” (OMB, 2023a, p. 65). The guidance provided by these updated circulars allows for agencies to conduct quantitative, qualitative, and tailored distributional analyses to meet statutory mandates (such as the EOs described earlier in this chapter) and to account for the effects on the welfare of a community.

Though these circulars have far-reaching impacts throughout the federal government (Newell et al., 2024) and are important sources of methodological guidance with relevance to USACE projects, water resources projects are specifically exempted from the scope of Circular A-94. Guidance for water resources projects is provided by the *Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies*, referred to in shorthand as the PR&G (CEQ, 2014).

2.5. EJ PRACTICE IN USACE PROJECT PLANNING

This section provides an overview of the history, extent, and current implementation of federal laws, policies, and practices related to EJ. Because the remainder of this report will focus on case studies from USACE, this review closes with an examination of how USACE’s Civil Works Mission interacts with these EJ laws and policies.

The USACE Civil Works Mission is to serve the public by providing the Nation with quality and responsive management of the Nation’s water resources through: support of commercial navigation; restoration, protection and management of aquatic ecosystems; flood risk management; and providing engineering and technical services in an environmentally sustainable, economic, and technically sound manner with a focus on public safety and collaborative partnerships. In pursuit of this mission, Civil Works is bound by laws, including NEPA and WRDA, as well as guidance from EOs and DoD, Army, and USACE leaders. Because USACE projects are authorized by Congress (in WRDA, for example), these projects are primarily bound by statute, superseding agency guidance from EOs when in conflict.

The Civil Works mission requires managing many of the Nation’s water resources, and as such USACE also must follow the PR&G, the comprehensive policy and guidance for federal investments in water resources (CEQ, 2013). The PR&G are a framework for assessing economic, environmental, and social impacts. The PR&G also explicitly encourages agencies to integrate their PR&G analyses within existing planning processes and documents, such as those required by NEPA. The PR&G were developed by CEQ and finalized in 2013 as an update to the 1983 Principles and Guidelines (U.S. Water Resources Council, 1983), as directed by the Water Resources Development Act of 2007.

The Water Resources Development Act of 2020 (WRDA 2020) directed the Army to issue Agency Specific Procedures (ASPs) necessary for the USACE Civil Works mission to implement the PR&G. These draft ASPs were published in the Federal Register in February 2024 for public comment (USACE, 2024). The ASPs of the USDOJ were used as a basis, given that the Bureau of Reclamation has similar water resources investments to the USACE Civil Works mission. Some highlights of the draft ASPs include:



- A goal of maximizing public benefit relative to cost, with public benefit defined and emphasized as encompassing a broad range of economic, environmental, and social outcomes that extend beyond their monetized value.
- A requirement to develop alternatives that first seek to improve environmental conditions, and to include a fully nature-based alternative and an environmentally preferred alternative in the final array of alternatives evaluated.
- An emphasis on application of multiple methods for benefits evaluation, including monetization, quantification of outcomes through metrics other than dollars, qualitative determination of outcomes.
- Prescribed use of multi-objective analysis to consider tradeoffs across monetized, quantified, and qualified outcomes without weighting based on the method of benefit evaluation, and the continued assessment and updating of these tools and methods.
- An emphasis on procedural equity and EJ, including improving engagement with Tribal Nations and other EJ communities, integrating the NEPA and PR&G processes, and including disproportionate burdens and other EJ factors in evaluation.

While these ASPs are not final as of the time of writing, the details above show how policy is evolving to become more consistent across EOs, agency guidance, rulemaking, and strategic planning.

Additionally, USACE is implementing Justice40 across its Civil Works programs. Currently, 11 USACE programs are considered “covered programs” under Justice40, including the Continuing Authorities Program (CAP), Floodplain Management Services, Planning Assistance to States, Aquatic Ecosystem Restoration (Construction and Investigations), and Flood and Storm Damage Reduction Program (Construction and Investigations). Covered programs under Justice40 include programs making investments in climate change, clean energy, clean transportation, affordable housing, training and workforce development, remediation of legacy pollution, and critical clean water and waste infrastructure (OMB, 2021a). While the goal of Justice40 is to distribute 40% of the benefits from covered programs, currently USACE is tracking the distribution of funding from covered programs, as not all benefits and the distribution of those benefits have been quantified. According to USACE’s Environmental Justice Scorecard, over \$1 billion in funding from covered programs has been made available from discretionary, mandatory, and supplemental appropriations, though how much of that funding reached disadvantaged communities was not specified.

In summary:

- USACE is bound by statutes, including NEPA, and must follow the process outlined in NEPA (including meaningful engagement, scoping, defining the affected environment, developing and selecting alternatives, identifying minority and low-income populations, analyzing impacts, and mitigation and monitoring).
- USACE is directed to implement Justice40 as outlined in the Executive Order, though the method(s) of accounting for benefits of covered programs are not proscribed.



- USACE water resources projects within Civil Works are exempted from Circular A-94 and are covered by the guidance in the PR&G. However, it may use guidance from A-94 where it does not contradict the PR&G.
- USACE’s draft ASPs for implementing the PR&G would codify in rulemaking some of the updated methods, approaches, and policies seen in other federal planning documents related to EJ.
- USACE has significant flexibility in how its own processes fulfill the various EJ requirements outlined in this chapter aside from statutory requirements.

2.6. SUMMARY OF FEDERAL POLICY FOR EQUITY ANALYSES

This review of federal policy documents related to EJ and equity analyses shows that agencies have broad discretion over how they analyze EJ impacts, but the goals of federal and executive initiatives continue to grow in both scope and intensity. Several themes and questions emerged from the study team’s initial review.

Source of policy: Policy directives can emanate from statutes, EOs, agency guidance, case law, and other sources. This variety of potential sources leads to questions of which source(s) are predominant. The process outlined in NEPA, based in statute and followed by agencies since 1970, supports consistency, especially between presidential administrations, and to avoid being “arbitrary and capricious” with agency decisions. However, presidential EOs do not grant a right of action in courts.

The NEPA process begins with a scoping process, which, according to § 46.235, is a process that takes place during the early stages of preparation of an EIS. However, Justice40 requires federal agencies and departments to review the environmental justice process prior to the official scoping phase and examine the broader distribution of benefits resulting from a project. This shift may result in a pre-scoping analysis of the project selection process, including budgetary allocations. Justice40 seeks to ensure that 40% of federal investment benefits flow to disadvantaged communities. This shift in focus from avoiding disproportionate harm to actively incorporating benefits to disadvantaged communities into projects does leave questions remaining. For example, when crafting guidance to address Justice40, will agencies pull NEPA definitions ‘upstream’ to their project selection and budget allocations, or will a new set of definitions shape their response to the Justice40 initiative?

Identifying the affected area: The largest gap in EJ assessment processes that was identified in the study team’s review is related to identifying the affected environment. Agency guidance focuses on identifying minority and disadvantaged communities within predefined project boundaries. While these affected communities should be part of the analysis, projects subject to this guidance have wide-ranging impacts that can extend far beyond a project boundary. New guidance such as Circulars A-4 and A-94, as well as EO 14008 and EO 14096, encourage agencies to extend boundaries to show and quantify additional benefits to communities; however, the findings of a required EJ assessment may materially differ based on the boundaries chosen. This gap in defining and understanding a project’s affected area is a critical component of understanding impacts and benefits to communities, and the USACE draft ASPs highlight this as well with the need to understand upstream and downstream impacts of proposed projects and alternatives.



Creating equitable procedures for project scoping: These two concerns, pre-scoping analysis and defining the affected area, point to a gap that the agencies themselves might be left to address: how are projects and their boundaries generated, and what mechanisms do communities have to influence or weigh in on those considerations? Existing guidance is specific and implementable once a project is scoped, but the larger question of how to, for example, develop a portfolio of projects where 40% of benefits flow to disadvantaged communities remains unanswered. Any processes to address this may need to be open, iterative, and flexible, in order to analyze potential benefits and impacts in multiple phases with alternatives scoped within different boundaries. This gap is of particular importance to USACE, because for several Civil Works service lines, equity or EJ concerns can only be addressed by request and with local cost share commitments.

Challenges of scaling from project to program: High-level guidance issued by agencies appeared to shift the burden on developing more specific implementation plans to other agency personnel, leaving it unclear how the agencies plan to achieve the lofty goals set out in executive orders. The study team was unable to find clear guidance for agencies working on or near tribal lands. Language such as “to the greatest extent practicable”—while stronger than the former language “whenever practical and appropriate”—still may accommodate those who would deem equity implementation impracticable. Methodological guidance based on concepts like OSE exists in some agencies, including USACE, and the future of these approaches in light of new programs like Justice40 is unclear.

In the 20 years since the signing of EO 12898, federal agencies and departments have developed several guidance and strategy documents to support efforts to incorporate EJ into their activities. USACE, for example, specifically noted in a recent EIS for the Mississippi River & Tributaries Project that their methodology for assessing EJ was drawn from CEQ’s 1997 *Environmental Justice Guidance under the National Environmental Policy Act*, DoD’s 1995 *Strategy on Environmental Justice*, and USEPA’s 2016 *Promising Practices for EJ Methodologies in NEPA Reviews* (USACE, 2020). Each of these federal guidance and strategy documents have been adaptively developed and utilized in combination by federal agencies to address EJ as required under EO 12898. The signing of EO 14008 in 2021 represents an update to the EJ framework established by EO 12898, requiring federal agencies and departments to conceptualize the impacts of their actions on low-income and minority communities in new ways.

By including an additional focus on establishing benefits, the Justice40 Initiative, a key component of EO 14008, will require federal agencies and departments to develop new methods and tools to address the EJ impacts of their activities. While new analytical tools such as the CEJST have been developed to assist agencies in their EJ assessments, USACE guidance notes that “it is not sufficient to rely solely on [geospatial] tools to identify disadvantaged communities” and that achieving environmental justice will require a combination of quantitative and qualitative methods (Collaboration and Public Participation Center of Expertise, USACE, 2023). This present review of federal EJ policy documents provides the policy grounding necessary to address the broad societal goals established by EO 12898 and EO 14008 in a scientifically sound and legally defensible way.



3.0 METHODS

While much of the federal EJ guidance focuses on terminology from EO 12898 related to avoiding “disproportionately high and adverse human health or environmental effects on minority populations and low-income populations” (EO 12898, 1994), other federal guidelines emphasize the need for “fair treatment and meaningful involvement” of these populations in the development, implementation, and enforcement of environmental laws, regulations, and policies (Kuehn, 2000; National Academies Press, 1999). Additionally, EO 14008 requires that agencies take steps to ensure that 40% of federal investment benefits flow to disadvantaged communities (Executive Order No. 14008, 2021). This recent guidance has added emphasis on establishing benefits, in addition to demonstrating that the federal government is attempting to avoid harm. Given this broadening view, federal agencies seeking to identify and address the EJ impacts of their actions must necessarily take a multi-tiered approach, including examining distributional equity and procedural equity. As specific guidance for multi-dimensional equity analyses does not currently exist, analyzing each of these EJ taxonomies requires a distinct set of analytical tools.

This section presents a set of EJ research methodologies and frameworks used by the study team to re-analyze the potential disproportionate impacts and equity-weighted benefits of a range USACE public works projects. The methods used to assess the potential impacts and benefits of each project are context-dependent, based on the specific goals and planned activities of each individual project. While structural and recognition equity are important dimensions of equity for project planning, they are difficult to quantify and thus were omitted from this analysis. The following methods are provided as examples of scientifically accepted approaches that have been used to quantify the EJ impacts of proposed environmental projects.

3.1. CASE STUDY REANALYSIS APPROACH

This research uses a retrospective case study analysis to test several analytical tools in service of assessing multiple dimensions of equity. The case studies used in this research study were selected for a previous report (Fischbach, Dalyander, McHugh, et al., 2023) that tested methods of benefit quantification and monetization for natural and nature-based features (NNBFs) of USACE projects. These case studies were selected after a review of 150 feasibility studies conducted from 2005-2020 using a 2-round scoring process and feedback from USACE leadership, as detailed in Windhoffer et al. (2022). The study team elected to use these same case studies for this analysis to build on the body of research developed for that report. One case study used previously, Jacksonville Harbor, was not used here, and was replaced with the Jamaica Bay-Hudson Raritan Estuary case study.

There are inherent limitations to a retrospective analysis, including that the laws, guidance, and policies were not all uniform when the original studies were completed. First, this application of methods is not intended to undermine or question the findings of the USACE feasibility studies examined herein. This research study is also not an evaluation of how well those original feasibility studies met these newer policy requirements, but rather an opportunity to test how they might have worked if the tools and methods were available to the teams at that time. The analyses presented in this report explore the effectiveness of new policies and methods on potential decision-making in the future. Further, because the intent is that these analyses are decision-relevant and implementable, application using existing USACE projects was determined to be the best approach.



3.2. DISTRIBUTIONAL EQUITY ANALYSIS

Distributional equity is when “policies and programs result in fair distributions of benefits and burdens across all segments of a community” (Park, 2014). This is not synonymous with equalitarianism—social goods “may be distributed to explicitly improve the welfare of the disadvantaged” (Meerow et al., 2019). In a water resources context, distributional equity focuses on the allocation among residents of costs and benefits resulting from environmental policy, resource management decisions, and environmental modifications. Analyses of distributional equity are highly dependent on the individual facts and circumstances of each proposed action, the affected environment, and the affected populations (CEQ, 1997). At its most basic, such analyses must examine environmental burdens and where are they located as well as the equitable distribution of those burdens (Corburn, 2017; Kuehn, 2000). As noted in the prior chapter, recent changes in federal policy have placed additional foci on the distribution of environmental benefits derived from government and private-sector programs. Advances in high-end computing, numerical modeling, data availability, standardized tools, and geographic information systems (GIS) have allowed analysts and researchers to develop analytical techniques to measure the burdens and benefits of environmental projects on low income and minority residents over various spatial and temporal scales.

3.2.1 Delineating the Affected Environment

One of the first steps of a distributional equity analysis is to determine the outer boundaries (i.e., footprint) of each project alternative. While federal guidelines establish that defining the affected environment is a critical component of EJ assessments, they do not prescribe how that footprint should be derived, noting that unique conditions such as human health vulnerabilities, socioeconomic vulnerabilities, and cultural vulnerabilities may influence how the affected environment is derived (IWG on EJ & NEPA Committee, 2016). When appropriate, agencies can use community input and the local knowledge of residents and key stakeholders to refine and more accurately define the affected environment (IWG on EJ & NEPA Committee, 2016). For this analysis, the study team applied several methods to delineate the affected environment depending on the specific data analyzed for each project. When a case study project was designed to provide flood risk reduction benefits, for example, the hydrologic and hydraulic modeling domains previously developed for the project were used to define the affected area. In these cases, the analysis shown in this research is intended to serve as a proof of concept for the measurement of distributional equity within the established project footprints identified by the modeling and not a reanalysis of the modeling itself.

However, it is important to note that the affected environment for analysis can sometime be larger than the immediate geographic boundaries of the action under consideration (IWG on EJ & NEPA Committee, 2016). For example, in USACE projects that generate recreational or aesthetic benefits, those benefits may extend beyond the project footprint itself. In such cases, the accessibility of such sites by nearby residents and community members was an important component of the analyses. In multipurpose studies, there are likely to be multiple impact areas or benefit areas, depending on the category of impact or benefit. To determine the affected environment, the study team performed a buffer analysis in GIS and calculated the population within a 10-minute walking distance from public access points. Rather than creating a buffer around access points using Euclidean distance, service areas model the movement of people or vehicles along transportation networks. The object of this analysis was to model the shortest paths along the street network from residential locations. A set of polygon service areas were generated



around each access point. This analysis utilized the Make Service Area Analysis Layer function within the ArcGIS Network Analyst geoprocessing toolbox.

While each USACE project may have a single primary goal, such as reducing flood risk, improving navigation, or increasing opportunities for recreation, the study team anticipated that there was likely be several other positive or negative impacts to nearby residents that would need to be accounted for in the distributional equity analysis. For example, several of the case study projects analyzed in this research identified potential areas that would be directly disturbed by construction activities and equipment as well as those expected to be impacted during operation and maintenance following construction. These impacts included reduced air quality, noise pollution, and increased traffic. To the extent that the affected environments related to these construction, operations, and maintenance activities were described or mapped in the USACE project documentation, they were delineated and included in the distributional equity analysis for that project.

3.2.2 Identifying the Affected Populations

To assess the EJ and equity impacts of USACE projects, it is necessary to have spatially accurate population location data at the finest scale available. Datasets developed by the U.S. Census Bureau—the decennial census and the American Community Survey (ACS)—provide the most accurate accounting of population currently available. These data sources represent the most comprehensive secondary datasets available upon which to develop baseline conditions, gathering information about population and income distribution, employment by sector, education, housing type, and other social factors at the community, county, regional, and state levels.

While data derived from the decennial census and the American Community Survey are often used interchangeably by analysts, there are several notable differences between these. The decennial census is a count of every person living in the 50 states, the District of Columbia, and the five U.S. territories and is conducted every 10 years. The decennial census questionnaire asks a shorter set of questions, including age, sex, race, and Hispanic origin. The ACS, on the other hand, is a nationwide, continuous survey designed to provide demographic, housing, social, and economic data for all established census geographies. It replaced the decennial census long form in 2010 and provides a broader range of measures that describe the average characteristics of population and housing, such as income, education, and employment, over a 1- and 5-year period of data collection. (Hijuelos & Hemmerling, 2016).

Due to differences in the sampling methodologies utilized by the U.S. Census Bureau, the ACS has much larger margins of error than the decennial census. Areas with populations of less than 20,000, such as small towns, census tracts, and census block groups, will have annual ACS updates based on five previous years of data. Because sampling error generally increases as the sample size decreases, sampling error will be most apparent with these small census geographies (Williamson, 2008).

To measure impacts on racial minorities and Hispanic populations, this analysis utilizes census block data derived from the 2020 decennial census (Table 3-1). The U.S. Census Bureau follows standards on race and ethnicity set by the OMB, which establishes a minimum of five racial categories: White, Black or African American, American Indian or Alaska Native, Asian, and Native Hawaiian or Other Pacific Islander. For ethnicity, the federal standards classify individuals in one of two categories: “Hispanic or Latino” or “Not Hispanic or Latino.” The U.S. Census Bureau also includes categories for people who do



not identify with any of the listed racial categories and for multiracial populations. To assess economic costs and benefits, the analyses use census block group data derived from the ACS 2017–2021 5-Year Estimates. While the 5-Year Estimate is the least current of the ACS datasets available, it is the most accurate and reliable as it utilized the largest sample size (U.S. Census Bureau, 2020). The 5-Year Estimate is also the only ACS dataset available at the census tract and block group level. To assess the distributional impacts of USACE projects on low-income residents, this analysis used block group-level ACS data on the number of people below the official poverty rate in 2020. Block group-level data on median household income were used to calculate equity-weighted BCAs for each of the USACE projects reviewed.

Table 3-1. Data sources used in distributional equity analysis and analysis of equity weighting in BCA.

Data Source	Purpose	Application
U.S. Census Bureau 2020 Decennial Census: Census Block Data	Used to measure distributional impacts of USACE projects on racial minorities and Hispanic populations	Distributional Equity Analysis
U.S. Census Bureau ACS 2017–2021 5-Year Estimates: Census Block Group Data	Used to assess the distributional impacts of USACE projects on low-income residents	Distributional Equity Analysis
U.S. Census Bureau ACS 2017–2021 5-Year Estimates: Census Block Group Data (Median Household Income and Per Capita Income)	Used to assess economic costs and benefits	Analysis of Equity Weighting in BCA

3.2.3 Population Interpolation

While census blocks and block groups are the finest-scale data made available by the U.S. Census Bureau, these “flat” boundary files possess limitations that limit their utility in local-level vulnerability assessments such as those required when conducting environmental justice and equity assessments. When mapping data by census geography, there is an implicit assumption that the population distribution within the aggregated areal units are homogeneous (Mitsova et al., 2012). However, census blocks and block groups can contain broad areas of unpopulated land, particularly in rural locations, necessitating additional geospatial analysis of the census data.

One technique used by researchers and federal agencies such as the USEPA to better define the location of impacted populations in EJ and equity analyses is dasymetric mapping. Dasymetric mapping is a technique to interpolate and disaggregate the population counts within various census geographies to smaller areal units (McMann et al., 2023; Mitsova et al., 2012). Through dasymetric mapping, the population within each census unit is distributed based on a secondary dataset, generally a land use land cover (LULC) dataset.

For this analysis, the USEPA Intelligent Dasymetric Mapping (IDM) toolbox was used to interpolate the census block level data from the 2020 decennial census down to the 30 m pixel level using the 2019 National Land Cover Dataset (NLCD). The IDM tool incorporates state-specific population density



estimates for each NLCD land cover class that is used to distribute population within the census block (Table 3-2; Baynes et al., 2022). These values are derived from actual population values for each state and are based on impervious land cover. Developed - High Density would have 80%-100% impervious cover, which could include high population places like New York City, but for Louisiana or Mississippi might be oil refineries with a very low population. State-specific values correct for these differences. Further, 'developed open space' would include recreation areas, golf courses, but also large-lot single family home developments. The IDM process distributes census-derived population values according to these state-specific values and the resultant raster output gives an estimated number of people per pixel that are expected to reside in that land cover class throughout the state and more clearly delineates unpopulated locations across the study area (Figure 3-1). This dataset also provides a more accurate assessment of population density in coastal communities where residents often reside on the limited high ground along lakes, rivers, streams, and bayous.

Table 3-2. Sample population density values used to interpolate population by land class in the Intelligent Dasymeric Mapping Toolbox for the State of Louisiana.

Land Class	Population Density Values (30m Pixel)
Uninhabited	0
Open Water	0
Perennial Ice/Snow	0
Developed, open space	0.45
Developed, low intensity	1.6
Developed, medium intensity	1.4
Developed, high intensity	0.38
Barren land (rock/sand/clay)	0.0007
Deciduous Forest	0.021
Evergreen forest	0.002
Mixed Forest	0
Shrub/scrub	0.015
Grassland/herbaceous	0.0062
Pasture/hay	0.0074
Cultivated crops	0.0022
Woody wetlands	0.00083
Emergent herbaceous wetlands	0

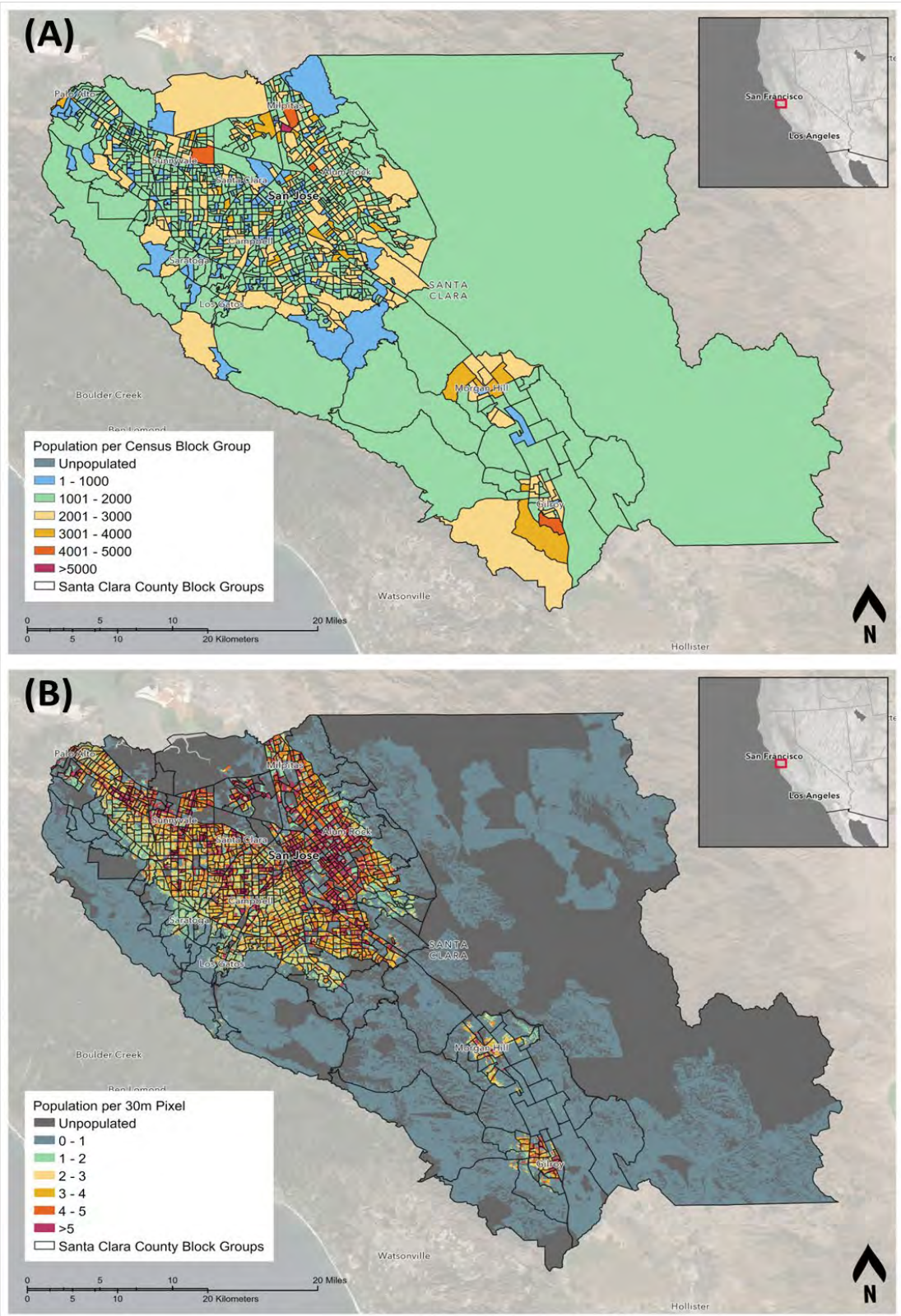


Figure 3-1. Distribution of population in Santa Clara County, CA based on Census block group (A) and by 30 m pixel derived through dasymetric mapping (B).



Dasymetric mapping outputs were generated for each of the study areas to assess the EJ impacts and the equity weighted benefits resulting from each of the USACE projects analyzed. The resultant 30 m pixel-level population counts were used to more accurately map the location of the affected populations.

Additional analysis of the raster outputs, including the generation of population weighted centroids for all blocks and block groups within the study area, were conducted using the raster math functionality of ArcGIS Pro. Population weighted centroids estimate the center of population within each census unit rather than the geometric center and more accurately identify census units that fall within specified impact zones. The use of dasymetric mapping and population weighted centroids in EJ and equity analyses will result in improved spatial accuracy and better delineation of potentially impacted populations by identifying census blocks or block groups where the majority of the population resides outside of the impact zone (Figure 3-1).

3.2.4 Geostatistical Analysis

The geostatistical analysis for each case study began with a review of all USACE-identified boundaries for each project, to determine which one made the most sense to use for an assessment of impacts. For most of the case studies, the study area boundary delineated by USACE was used, unless there was a separate hydrologic model domain specifically for flood risk impacts. Once the areas of potential impact and communities of EJ concern were identified, the next step in the analysis was to assess the association between these variables and analyze bivariate associations using Pearson product moment correlations. To determine whether census block-level environmental inequities exist in relation to race and ethnicity (Black, Asian, Hispanic, and Native American populations), a series of statistical analyses used in previous EJ studies were conducted on the data (Hemmerling & Colten, 2017).

Nonparametric procedures were used to analyze EJ within specified project impact areas relative to the demographic makeup of the population of the study area outside of these areas. The chi-square test of significance was used to test the hypothesis that the row and column variables in a crosstabulation are independent. In this instance, a low p-value would indicate a significant relationship between a vulnerable population group and proximity to the specified activity.

While the chi-square test may indicate that a relationship exists, it does not indicate directionality. To assess directionality, this research used odds ratios and relative risk estimates. Odds ratios make inferences about how much higher or lower are the odds of a socially vulnerable individual (relative to an individual that is not a member of that specific vulnerable population) living in proximity to a potentially hazardous activity (Hemmerling & Colten, 2004; Pine et al., 2002). An odds ratio of 1 serves as the baseline of comparison and implies that the two variables being compared (social vulnerability versus physical vulnerability) are independent. Values of odds ratios that deviate from 1 imply that there is either a positive or negative relationship between the two variables.

USEPA regulatory guidelines establish the need to evaluate impacts on population groups of concern in relation to another group, typically referred to as a comparison group (U.S. Environmental Protection Agency, 2019). It is also important that exposed and nonexposed group members be compared to establish disproportional impact. The odds ratio represents a simple yet powerful statistic that accounts for both populations of concern and the comparison populations. It also compares population groups located near with those far from the hazard source. Odds ratios that are above 1 indicate that the



demographic group has a higher level of risk and therefore has a higher potential of being disproportionately impacted.

3.3. PROCEDURAL EQUITY ANALYSIS

In addition to analyzing the equitable distribution of benefits and avoidance of disproportionate harms, the study team also evaluated procedural equity in each case study. Procedural equity “references the processes and agents of decision-making, including the authentic engagement and empowerment of all stakeholders” (Junod et al., 2021, as cited in Bullard, 2005) and ultimately “refers to the issue of ‘fairness’” (Bullard, 2004) in procedures. With consideration of these principles, the study team examined each case study’s public engagement processes to determine the extent to which communities impacted by USACE’s proposed projects and plans were meaningfully engaged throughout plan development. The term “meaningful engagement” means different things to different agencies, and USACE has an opportunity define this further and decide what engagement must include in order to qualify as meaningful. For the purposes of this analysis, the study team uses the term “meaningful engagement” to discuss engagement that has proportionately involved members of the community within the impact area boundary.

The following subsections describe the study’s analysis of stakeholder engagement procedures during the scoping and report draft phases of each case study, as well as the process for reviewing public comments. The study team relied on these methods to evaluate whether public engagement was effective and to identify gaps and opportunities for ensuring equitable practices in the future.

3.3.1 Analysis of Stakeholder Engagement

To evaluate whether the public, and particularly disadvantaged and underserved communities, were meaningfully engaged throughout each case study, the study team analyzed both the procedures undertaken and the qualitative data collected through the outreach and engagement processes conducted by each USACE project team. The study team developed a framework for evaluating EJ activities in each case study based on recommendations from the IWG on EJ and NEPA Committee for the NEPA process (IWG on EJ & NEPA Committee, 2016), as well as from principles outlined in the *Interim Environmental Justice Strategic Plan: Community Outreach & Engagement* (USACE, 2022).

The *IEJ (Interim Environmental Justice) Strategic Plan* (USACE, 2022) recommends that:

Each study activity must meaningfully incorporate considerations of the whole community in the scope of the study, including outreach, engagement, and communication planning reflected in the Project Management Plan. Communication plans for each study will acknowledge and include detailed steps to meaningfully engage with disadvantaged and underserved communities. Items to be considered include:

- Development of accessible and inclusive public meetings and other engagements with the whole community;
- Equitable access for community and public involvement, which may necessitate multiple and different types of engagement within the study area (e.g., face-to-face meetings, virtual meetings, translated documents, multiple avenues for broadcasting information or taking comments); and



- Identifying potential environmental justice concerns and ensuring stakeholder engagement and considerations are in partnership with the non-federal sponsor.

This guidance on community outreach and engagement applies to and complements the IWG on EJ & NEPA Committee’s recommendations for the NEPA process. Supplementing the IWG’s nine recommended steps—meaningful engagement, the scoping process, defining the affected environment, developing and selecting alternatives, identifying minority populations, identifying low-income populations, the impacts analysis, disproportionately high and adverse impacts, and mitigation and monitoring—with IEJ Strategic Plan guidance, the study team developed a series of questions to track for each phase of the project that involves public engagement (e.g., scoping and draft phases) and sub-phase (e.g., public notice, public meeting) to evaluate procedural equity in each feasibility study. These questions were formed to analyze whether study information and the types of stakeholder engagement were accessible and inclusive of the public/EJ communities impacted by potential projects proposed.

Upon evaluation of study processes, the team then analyzed public comments collected by the USACE project team for each case study to evaluate whether the root of comments was responded to and addressed. The following subsections describe the methodology developed by the study team for evaluating procedural equity in each case study.

3.3.1.1 Scoping Process

Beginning with the scoping phase, the study team evaluated the means and effectiveness in notifying the public. For example, although all feasibility studies distributed a notice of intent in the *Federal Register*, the *Federal Register* is unlikely to reach a general public audience. Therefore, the study team assessed each study for other means used to announce the study to the public and request their feedback, as well as whether these sources were locally accessible to the general public and particularly to underserved communities that may be impacted by the project. The team also assessed whether each public notice was clear about where/how to send comments and whether notice was translated into multiple languages for wider distribution and accessibility.

3.3.1.2 Public Meetings and Engagement Efforts

The study team also developed a framework/tracker to assess whether public meetings at each phase of the study were accessible, inclusive, and equitable (Table 3-3 and Table 3-4). These tables include a set of questions to assess for each phase of the study that involves public engagement to better track the level of public engagement throughout project planning.

Table 3-3. Example table demonstrating public meeting engagement.

Public Meeting(s)	Scoping	Report Draft
Was a public meeting held?	☑	☑
Meeting Notice		
Were public meetings announced through multiple avenues? (e.g., letter, email, social media, city website, etc.)	☑	☑



Public Meeting(s)	Scoping	Report Draft
Were underserved communities notified of the public meeting?	Unknown	Unknown
Translation		
Was the public meeting translated into multiple languages?	Unknown	Unknown
Were meeting presentations and materials translated into multiple languages?	Unknown	Unknown
Accessibility		
Did public meeting notice include information about handicap accessibility support (e.g., support for participants with hearing or visual impairments, transportation for participants with physical disabilities, etc.)?	Unknown	Unknown
Were meetings in-person?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Was more than one meeting held?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Were meetings held after 5pm?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Were meetings held in more than one location to accommodate diverse neighborhoods within the potentially impacted area?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Was the meeting space accessible by public transit?	<input checked="" type="checkbox"/>	No
Was the meeting space ADA accessible?	Unknown	Unknown
If conducted in person, was childcare offered?	Unknown	Unknown

The team also developed a checklist to track the processes for receiving and responding to public comments.

Table 3-4. Example table demonstrating public comment procedures and feedback.

Public Comment Procedures and Feedback	Scoping	Report Draft
Were there multiple ways for the public to communicate comments and feedback?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Was the public allowed to offer ideas and information about potential issues and impacts of the project (including EJ issues)?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Were there multiple avenues for publicly broadcasting comments and feedback?	Unknown	Unknown
Was the broadcasted information translated into multiple languages?	Unknown	Unknown
Were comments adequately addressed?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Were comments incorporated into plan formulation?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Were comments from individuals in underserved communities incorporated?	Unknown	Unknown



3.3.2 Review of Public Comments

Using the MAXQDA qualitative data analysis software (VERBI Software, 2021), the study team developed a set of cross-cutting structural codes applicable to all six case studies to identify the primary themes related to the public engagement processes conducted in each feasibility study. The MAXQDA software allows a user to upload documents and code segments within multiple documents to better track and understand trends.

To review public comments associated with each of the six case studies, the study team imported all available documentation related to public engagement (including letters, emails, oral comments, etc.) and coded public comments as well as the USACE project team’s response to determine whether public comments were sufficiently addressed throughout the study. This documentation is usually available in an appendix of a feasibility study. If the root of a single comment was responded to and, if appropriate, a plan of action to incorporate that comment was communicated, a comment was considered “sufficiently addressed.” An example of a comment not sufficiently addressed would be a sentence such as “thank you for your comment” in a response to a lengthy comment that requested specific information or warranted more follow-up.

The coding framework (Table 3-5 and Figure 3-2) established codes based on the type of comment received (e.g., email, public meeting, government, telephone, etc.) and the phase in which comments were received (e.g., scoping, alternative formulation, and draft phases). Public engagement and feedback varied widely across studies, so the coding framework also instituted codes to track community engagement methods utilized, means of public notice, the type of stakeholder engaged, and public concerns on the engagement process. Finally, the structure established codes to document the public’s perceptions of the proposed measures, projects, and/or plans, including those related to transportation, property values, aesthetic value, water quality, flood protection, ecology/environment, educational, cultural, recreational, economic, air quality, and public health and safety benefits as well as costs.

Table 3-5. MAXQDA parent codes.

	MAXQDA Parent Codes
1	Type of Comment
2	Type of Stakeholder Engaged
3	Public Concerns on Engagement
4	Quality of Material Provided
5	Community Engagement
6	Perceived Benefits
7	Perceived Costs
8	Public Meeting Phase

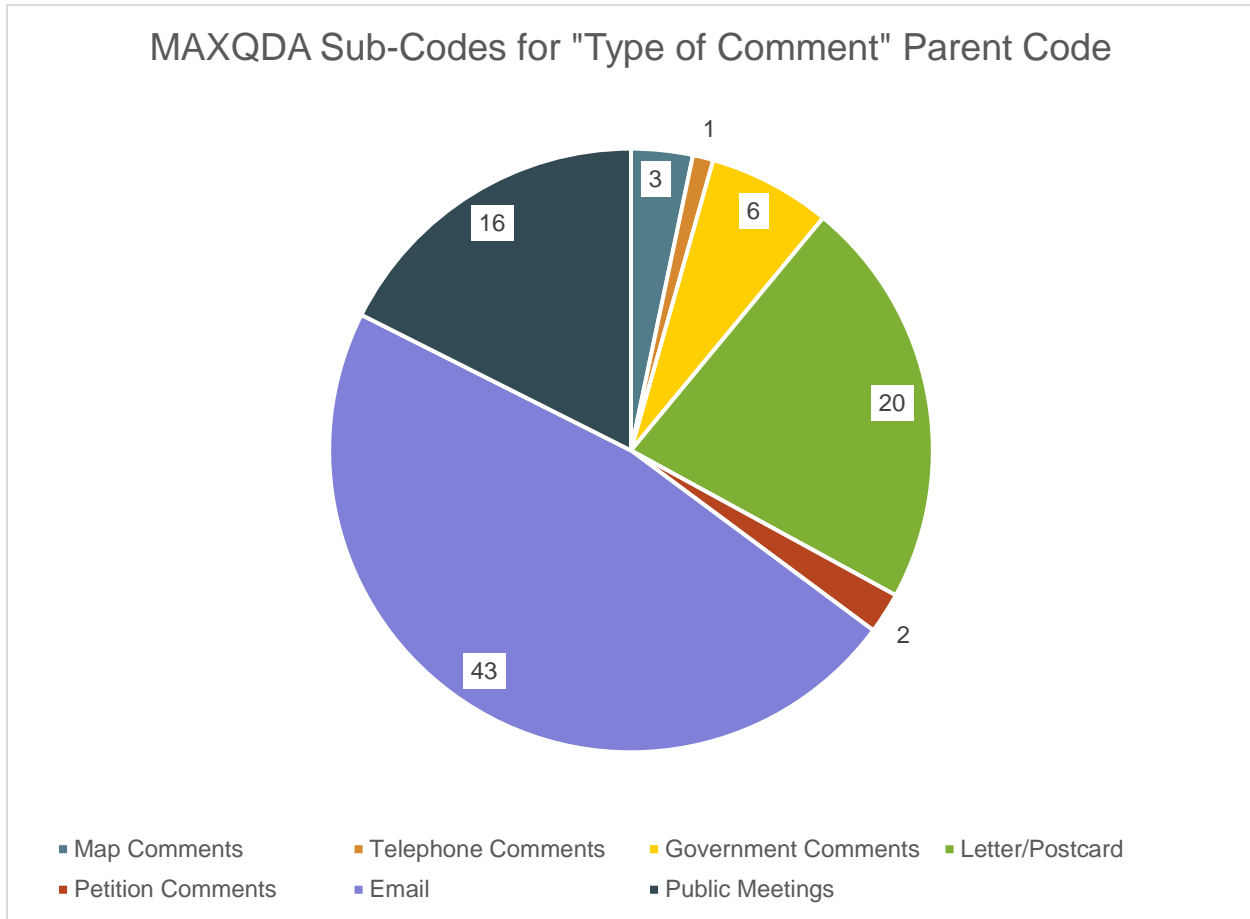


Figure 3-2. Examples of sub-codes for "type of comment" parent code.

3.3.3 Effective Engagement

Following the coding of public comments, the study team aggregated and reviewed comments and examined code segments more closely to find relatively high-volume comment categories. More specifically, sub-codes with the highest majority volume of comments for a single parent code were pulled for a more thorough review of the related coded segments by exporting all segments related to that sub-code into excel. This process was done to better understand what the USACE project team did well and what worked, to uncover any innovative strategies that were implemented by USACE throughout public comment periods, and to offer insight about the application of coding mechanisms throughout the duration of a project to support and enhance effective public engagement under new federal guidance.

3.3.4 Gaps and Opportunities

The process of coding public comments was limited by several factors. First, the study team coded what was available in each study, so if a study did not include comments from each phase (e.g., Southwest Coastal Louisiana did not include comments from the initial scoping meetings, only a table summarizing comments by category), they could not be coded. The quantity of comments is also dependent on stakeholders' awareness of the study/recommended plan, public meetings, and/or where to send comments. If public meeting notices were not widely advertised nor distributed through local news sources and thus, resulted in a relatively low number of comments from the public compared to the



population of the study area, the community’s interest in or concerns about the project may not be truly reflected. Finally, it is important to recognize that negative public comments almost always outweigh the positive ones. Therefore, coding and analyzing public comments is not an exercise in trying to understand the popularity of a proposed project, but rather a way to acknowledge and consider any legitimate concerns while ensuring the potentially impacted populations have been given meaningful opportunities to provide input. Acknowledging some of these limitations, the study team used the case studies as opportunities to evaluate the application of this coding exercise for unique projects, and capture use cases that could be applied across different contexts.

3.4. BENEFIT-COST ANALYSIS WITH EQUITY WEIGHTING

Finally, the study team conducted a quantitative re-analysis of selected benefits and costs from each case study. The benefit-cost analyses for each case study builds on the team’s previous report, *Enhancing benefits evaluation for water resources projects: Towards a more comprehensive approach for nature-based solutions* (Fischbach, Bond, et al., 2023). In that report, the team sought to estimate the additional benefits from NBS together with the benefits and costs originally calculated in each USACE study.

While this study was underway, OMB was working to update Circulars A-4 and A-94, as previously described in Section 2.4. With this update complete, the study team used these circulars to develop an equity weighting approach to evaluating benefits for these same case studies. Circular A-4 provides guidance on using weights, noting that “agencies may choose to conduct a benefit-cost analysis that applies weights to the benefits and costs accruing to different groups in order to account for the diminishing marginal utility of goods when aggregating those benefits and costs” (OMB, 2023a, p.65). Benefit-cost analyses of the USACE case studies were reevaluated to test these newly approved methods for incorporating equity considerations into analysis of project benefits.

3.4.1 Economic Rationale for Equity Weighting

Equity weighting is based on the idea of diminishing marginal utility, where an additional unit of a good is more valuable to a person if they have fewer total goods than if they have more total goods. This principle—that benefits are worth more to those who have less—is relevant across the USACE Civil Works Mission. For example, a flood risk reduction project in a wealthy neighborhood may provide a high level of modeled reduction in damage, but a flood risk reduction project in a lower income neighborhood may derive higher utility from a smaller level of damage reduction, owing to the differences in income and wealth.

Equity weighting accounts for this principle by inflating the monetary value of benefits to those who earn or have less than a reference income and shrinking the value of benefits to those who earn or have more than that same reference income. The resulting equity weighted benefit should, in theory, better reflect the actual impact of a project on the wellbeing of the people anticipated to benefit from it.

3.4.2 Process for Developing Equity Weighted Benefits

To develop equity weights, an analyst must use the income of the people affected by the project—requiring both a determination of a geographic impact area as well as detailed income data for that area. For privacy reasons, the U.S. Census Bureau does not publish individual income data, but instead aggregates this data at the block group level. Both the original USACE analyses and the reanalysis of



project benefits in Fischbach et al. (2023) were aggregated across the entire study area, rather than being broken down by census block group. To develop equity weights and test this methodology, the study team conducted two steps: 1) disaggregating benefits to the block group level, and 2) weighting each block group's benefit before reaggregating the weighted benefits. These benefits were weighted using county, state, and national references for comparison purposes.

To disaggregate the benefits to the block group level, two general approaches were used. Whenever possible, the benefits were assigned to individual people in the census block groups affected by the project. For example, for a benefit derived from Unit Day Value calculations, the benefit would be divided evenly among users. These users would then be divided among the different census block groups in the project area using the results from the dasymetric analysis (described previously in this chapter).

For benefits derived from flood risk reduction, the benefits were disaggregated using data from the National Structure Inventory. First, structures in the project area were assigned to census block groups. Then, the benefits were divided evenly among structures, and summed by census block group to get a total benefit for each block group. The study team also performed two alternative calculations. In one calculation, flood risk reduction benefits were simply evenly divided among block groups. In the other calculation, flood risk reduction benefits were apportioned to block groups proportional to the total structure value in the block group. The results for these alternative methods are included in 11.0 Appendix A.

To weight the disaggregated benefits, the following weighting formula was used:

$$\frac{\text{Block Group Median Household Income}^{-1.4}}{\text{Reference Median Household Income}}$$

This is derived from the guidance in Circular A-4, which says that “the weight for each subgroup is the median income for that subgroup divided by the U.S. median income, raised to the power of the absolute value of the income elasticity of marginal utility times negative one. OMB has determined that 1.4 is a reasonable estimate of the absolute value of the income elasticity of marginal utility for use in regulatory analyses” (OMB, 2023a).

Multiple reference median incomes were used for comparison purposes, including: the national median household income, the state median household income for the state in which the project was considered, or the county median household income for the county in which the project was considered (where applicable). Once the benefit for each census block group had been appropriately weighted, the block group equity weighted benefits were summed to get the overall project equity weighted benefit. These equity weighted benefits were usually greater or lesser than the originally calculated benefits, as equity weights do not generally average to one across all designated block groups. Notably all demographic values should be derived from the same year (or as close as possible) as the dollar year used for cost and benefits.

3.4.3 Benefit-Cost Analysis Recalculation

In the previous report (Fischbach, Bond, et al., 2023) the study team took both the original USACE calculated benefits and costs as well as newly monetized ecosystem service benefits and combined them



into a benefit-cost analysis calculation. Briefly, this process consists of converting the time series of costs and benefits into Average Annual Equivalent (AAEQ) values. AAEQ values represent the present value of a string of cashflows divided evenly across a project time horizon. The AAEQ benefit was then divided by the AAEQ cost to arrive at the project's benefit-cost ratio (BCR). A BCR less than one indicates a project has lower benefits than its costs while BCRs above one indicate that benefits outweigh costs. This calculation process was repeated in this study on the equity weighted benefits.

Because calculating the AAEQ benefit and cost requires converting cashflows across time into a present value it (and the associated BCR) is contingent on a selection of a discount rate. In the previous report, the study team used two discount rates typically used by USACE in benefit-cost analysis: 1) the water resources discount rate and 2) the OMB discount rate. The water resources discount rate does not have a constant value, and instead has varied over time. Thus, each case study had its own value for the water resources discount rate (see the individual case study chapters for specific values of water resources discount rates).

Historically, OMB has required a discount rate of 7%. However, the revised Circular A-4 now recommends that the discount rate reflect the social rate of time preference and uses the real rate of return on long-term U.S. government debt to approximate this figure. Accordingly, OMB now sets one default rate for all effects from the present through 30 years in the future, rather than setting up an elaborate schedule, and uses 1.7% plus a .3% inflation factor for a constant rate of 2% (OMB, 2023a). In this report, the study team used this new discount rate to calculate BCR values in all of the case study chapters. The team also conducted the analyses using the study-specific water resources discount rate and the previous OMB rate of 7%. The results for these other discount rates are provided in 11.0 Appendix A. USACE does set its own discount rate each fiscal year; for FY24, that rate was set at 2.75% (USACE, 2023b). This rate was not used for this particular research study so as to test the impacts of the other discount rates.



4.0 SOUTH SAN FRANCISCO BAY

4.1. INTRODUCTION

4.1.1 Study Area

The South San Francisco Bay Shoreline Phase I Study Area (Figure 4-1), located in Santa Clara County, California between Alviso Slough and Coyote Creek, consists of a series of former commercial salt harvesting ponds as well as the adjacent community of Alviso and a wastewater treatment facility (USACE, 2015a). The area is prone to tidal flooding due to its low-lying terrain, which is protected by non-engineered dikes. In addition, the loss of tidal wetlands has led to increased flood risk and severe degradation of habitat for salt marsh plants and wildlife, including special-status and endangered species. The South San Francisco Bay Shoreline project exists within a broader collaborative effort among federal, state, and local agencies to restore these salt ponds to tidal marsh.

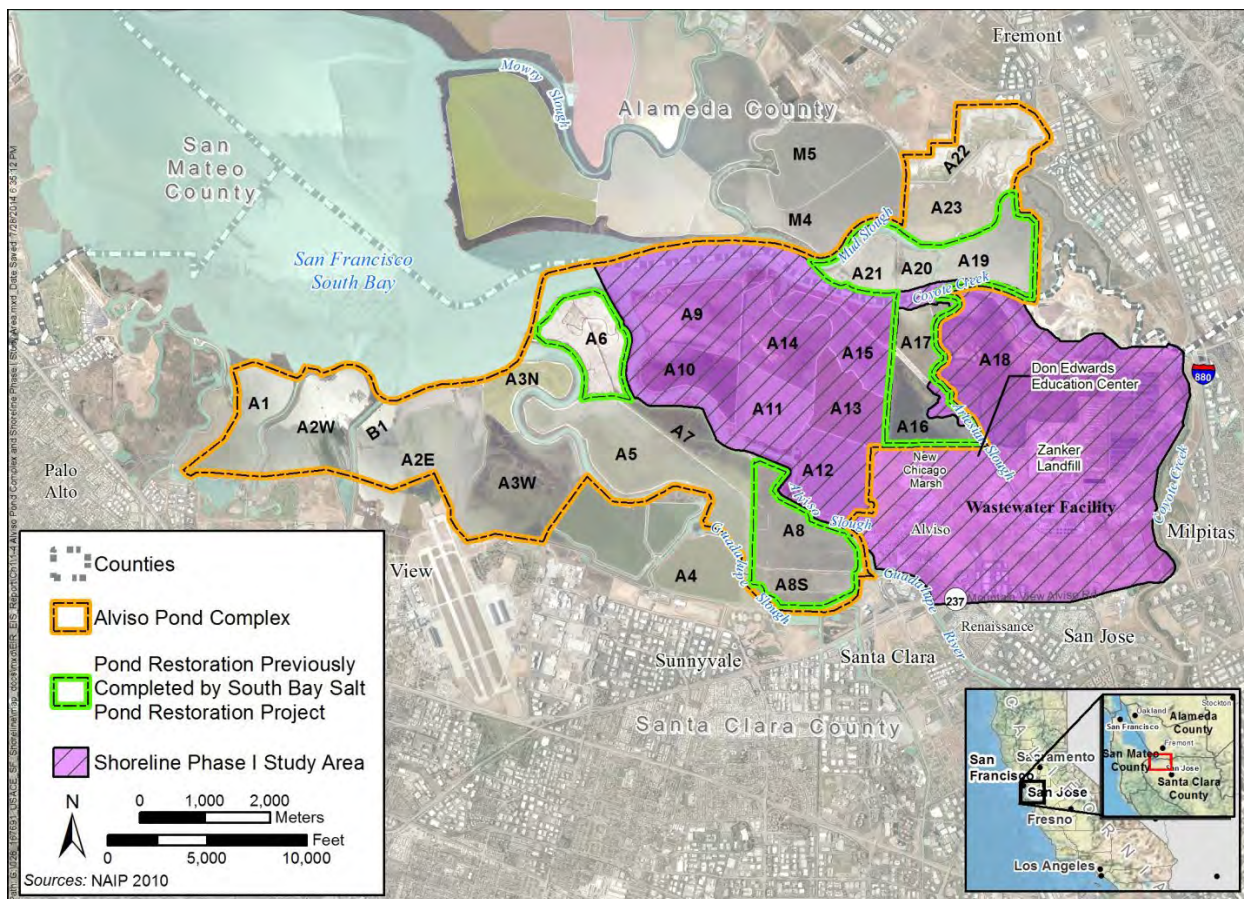


Figure 4-1. Study area: South San Francisco Bay.

4.1.2 Demographics

In the South San Francisco Bay flood risk reduction (FRR) benefit area, the three largest racial groups include people identifying as Asian (56.6%), people identifying as White (23.1%), and Other (8.8%). Additionally, 16.3% of residents in the FRR benefit area identify as Hispanic. At 56.6%, the Asian



population of this area is relatively large when compared to the Asian population of the reference area, which is Santa Clara County with an Asian population of 39.2%. (Table A-1).

The portion of the study area that would be impacted by project construction activities is less densely populated than the FRR benefit area, however, the demographic characteristics are similar. In this area, 62.9% of residents identify as Asian, 14.8% of residents identify as White, 11.5% of residents identify as Other, and 19.4% of residents identify as Hispanic (Table A-2).

4.1.3 Final Alternative

The non-Federal sponsors requested that USACE recommend the Locally Preferred Plan (LPP) because it met the FRM objectives and included ecosystem restoration opportunities. Compared to the NED/NER plan, the LPP (Figure 4-2) included a higher levee (15.2 feet instead of 12.5 feet) and included a larger ecotone transition zone for three of the salt ponds.

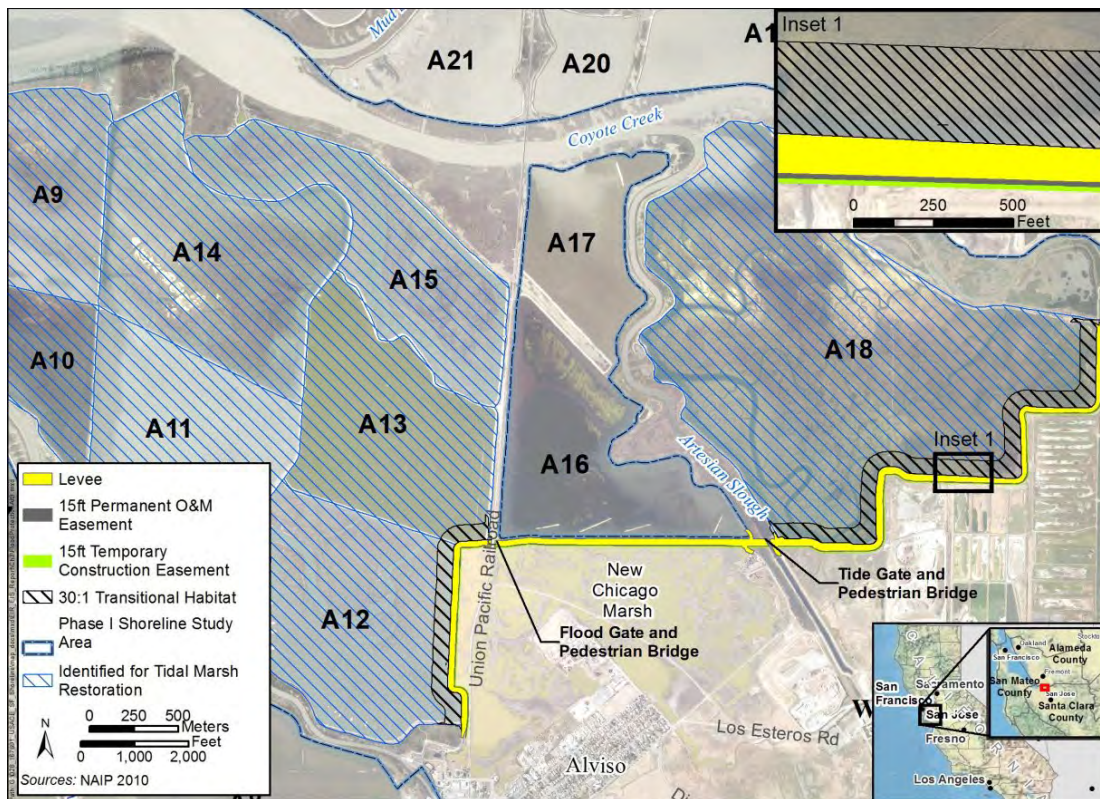


Figure 4-2. South San Francisco Bay Shoreline Study final alternative (Alternative 3; USACE, 2015a).

4.2. PROCEDURAL EQUITY ANALYSIS

4.2.1 Analysis of Stakeholder Engagement

4.2.1.1 Scoping Process

USACE, along with the US Fish and Wildlife Service (USFWS), the California State Coastal Conservancy and the Santa Clara Valley Water District (SCVWD), held a 30-day scoping process which sought public input on both project scope and document content. After the Notice of Intent (NOI; which



included details about the public scoping meeting) was published in the *Federal Register*, California State Clearinghouse, and two local websites, USACE received eight comments.

The public scoping meeting was held on a weekday in 2006 at the Milpitas Community Center, and 36 people attended. For the most part, attendees and commenters at the public scoping meetings were representatives from local government agencies. However, the 2014 rescoping only involved the public through acceptance of public comments submitted as mailed or emailed letters. USACE filed a draft Integrated Document (USACE, 2014) with the USEPA and a notice of availability for the document was published in the *Federal Register* on December 19, 2014. The California State Clearinghouse distributed a notice of completion to 26 interested and trustee agencies. In January 2015, USACE and the non-Federal sponsors held a public meeting to review the draft report and elicit public feedback. In addition to providing feedback at that meeting, the public also wrote and submitted letters to USACE (40 total).

4.2.2 Review of Public Comments

4.2.2.1 Stakeholder Comment Trends

Comments received during the public engagement process largely came from the general public, NGOs, and state government agencies (Figure 4-3). Local government and federal agencies were also well represented. Utility agencies and private businesses contributed fewer comments.

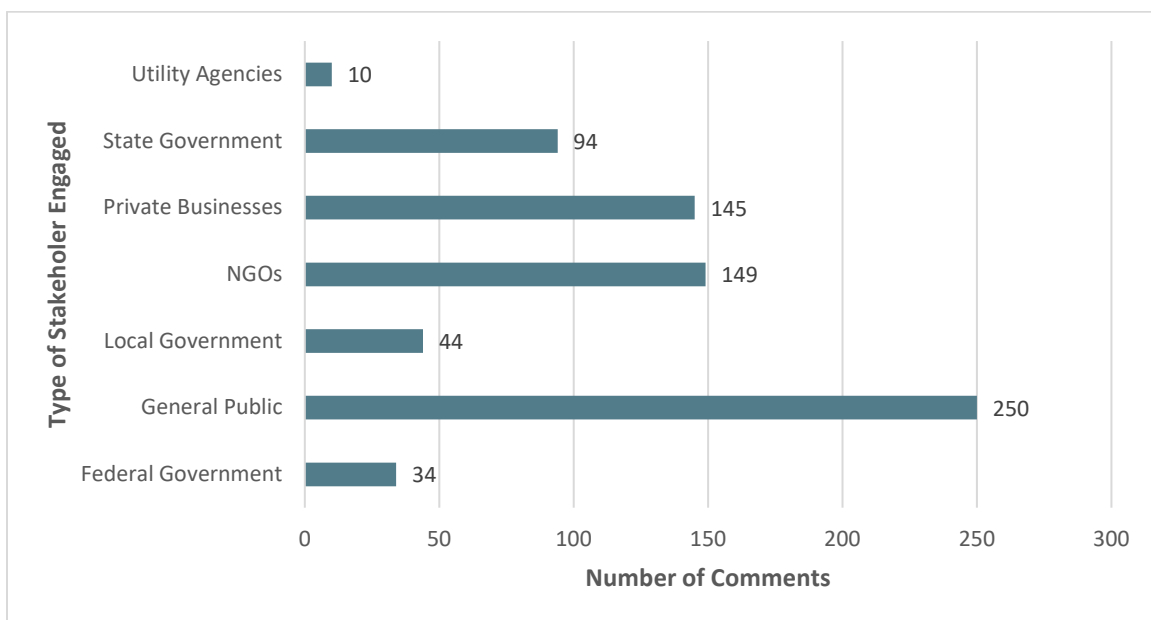


Figure 4-3. Types of stakeholder comments.

Comments on the 2014 draft report were largely submitted via email (92%). The rest were either government comments or letters/postcards.

USACE project team members tasked with responding to public comments parsed through emails and letters to highlight disparate questions and key concerns, even if there were multiple comments from one single person, and addressed them in organized tables which were subsequently provided to the public as appendices to the USACE study report.



4.2.2.2 Examples of Perceived Costs and Benefits

One major perceived cost reflected in public comments was the negative impact that select alternatives would have on water quality. Of all public comments related to water quality, only one reflected perceived benefits, while seven reflected perceived costs. Specifically, the public expressed concern about the proposed Artesian Slough flood wall and tide gate and its potential negative impact on both the environment and the Water Pollution Control Plant (WPCP) infrastructure. The public also communicated concern about the lack of public information about the WPCP, the potential negative impact of nutrient levels on the bay, and the potential negative impact of methylmercury on the bay. Public commenters suggested a more southern flood wall and levee alignment as a potential alternative, and recommended the incorporation of transitional zone features into levee designs to mitigate nutrient concentrations (Table 4-1).

Table 4-1. Examples of segments extracted by USACE of comments coded as “Perceived Water Quality Costs”. (USACE, 2014).

Segment
The analysis of the impacts of the flow control structure across Artesian Slough is inadequate. Multiple environmental impacts can be expected, including but not limited to a) isolating part of the slough; b) placing a levee between the existing mitigation wetlands to the east of Outfall Road and a restored A18; and c) potentially affecting the San Jose Santa Clara Regional Wastewater Facility plant discharge. It is not clear how the proposed structure would function, and whether tidal flows still be allowed in the part of the slough that is being separated from the Bay so as to not impact the slough’s habitat.
Nutrients: San Francisco Bay is a nutrient-enriched estuary but has been buffered from the potential negative consequences of elevated nutrient levels by a variety of factors. In the future, projected increases in water clarity and water temperatures will create conditions that could result in adverse impacts in the Bay as a result of high nutrient concentrations, including the potential proliferation of harmful algal species.
Recommendations: Discuss, in the FEIS, the benefits of levee designs that incorporate transitional zone features, including the creation of tidal marshes, and the ability of these ecosystems to take up nutrients at a high rate. Add the following information to Table 4.5-10, entitled, “Likely Future Status of Water Quality Contaminants in the Shoreline Phase I Study Area.” For the “Nutrients” block, add the Regional Monitoring Program’s Nutrients Strategy: The San Francisco Bay Nutrient Science and Management Strategy is a regional initiative for developing the science needed for informed decisions about managing nutrient loads and maintaining beneficial uses within the Bay in response to the apparent changes in the Bay’s resilience to nutrient loading. ² For the “Algae” block, add the National Coastal Condition Assessment, which will be sampling for harmful algal species in the Bay in 2015.



Segment

Understand that there is growing concern over outflow from San Jose Water Treatment Plant in times of flood when perhaps three days volume of treated water should be stored until South Bay tide levels recede. My math is no longer able to compute acreage of storage that is needed for three to four days of plant output but can appreciate that an isolated facility is preferable. Had always thought Pond 18 had been bought by City of San Jose for this purpose and so suggest that it be managed as a freshwater/recycled water marsh. Coastal Conservancy designed Emily Renzel Marsh in Palo Alto to handle limited treatment plant outflows. Can similar technology be implemented in Pond 18? Such use of Pond 18 with adequate levee protection would coordinate with my earlier suggestion of mosaic of managed marsh plain and floodplain, inboard of railroad line levee, in mode of Napa River flood retention. Ponds 16 and 17 could be managed like Island Ponds to attract different species of migratory and resident shorebirds with certain levels of salinity and depths of foraging tidal wetlands to suit their particular needs. The marsh plain floodplain, inboard of the railroad line levee, that I propose might have requisite capacity for two to three days fluvial stormflow, sufficient to mute reflux and overbanking between #237 and #101. It would be configured in horseshoe around Pond 18, extending from tide gates on Guadalupe River at Alviso around to tide gates on Coyote Creek main channel and overflow channel, to Coyote Creek mitigation SMHM (Salt Marsh Harvest Mouse) marsh.

4.2.2.3 Public Concerns About Engagement

Public comments for this project indicated concern about engagement methods and quality of provided materials. Of the 38 comments that expressed concern about engagement methods, 50% were concerned about the review timeline related to the draft Integrated Report, and 21% were concerned about unclear review processes (Figure 4-4). The remainder of these “concerns on engagement” comments were about lack of communication or materials that were difficult to understand. EO 13895 (The White House, 2021) contains language about engaging with stakeholders and communities who have been historically excluded from policy-making processes. More specifically, the EO calls for agencies to address “any barriers to full and equal participation in programs identified pursuant to section 5(a)” of the order (The White House, 2023a). If this study were to be conducted under EO 13895, extending timelines for draft report review and clarifying review processes in multiple formats across several platforms are some of the solutions that could be considered to minimize the types of administrative burdens referenced in the EO that prevent communities from meaningfully engaging in these multi-layered processes.

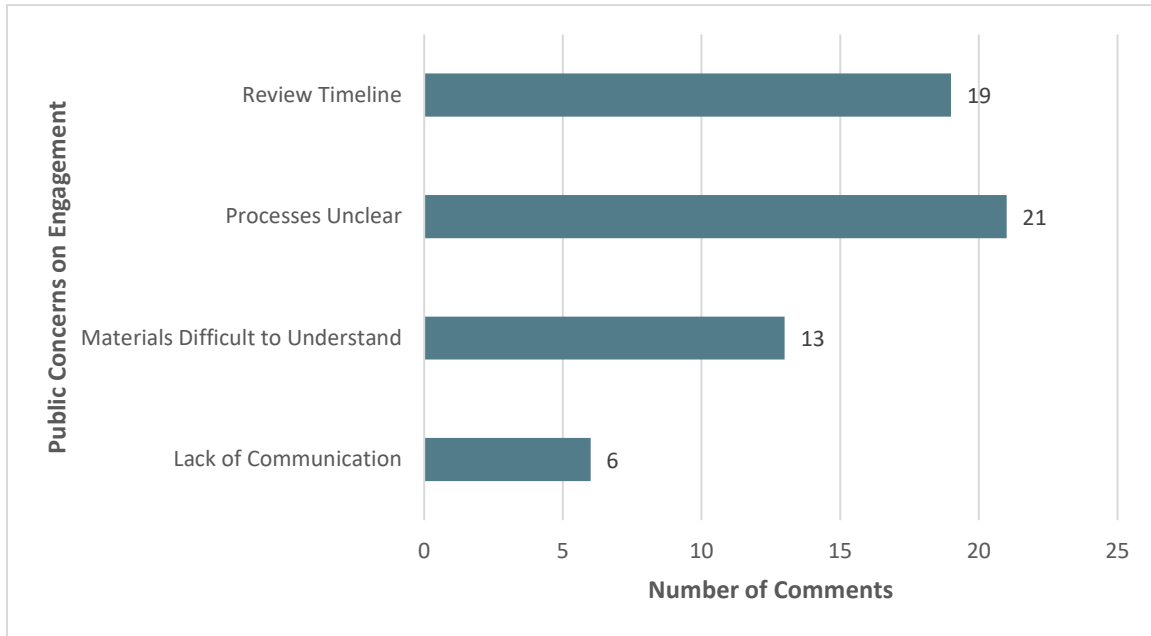


Figure 4-4. Public concerns on engagement.

There were nearly 80 comments that discussed the quality of materials provided in the draft Integrated Report. Of those comments, nearly half expressed concerns about missing data, and the other half reflected the need for incorrect data to be amended or for materials to be clearer. For example, one commenter noted: “The analysis of the impacts of the flow control structure across Artesian Slough is inadequate. Multiple environmental impacts can be expected, including but not limited to: a) isolating part of the slough; b) placing a levee between the existing mitigation wetlands to the east of Outfall Road and a restored A18; and c) potentially affecting the San Jose Santa Clara Regional Wastewater Facility plant discharge. It is not clear how the proposed structure would function, and whether tidal flows still be allowed in the part of the slough that is being separated from the Bay so as to not impact the slough’s habitat (USACE, 2014).” Finally, a small portion of these comments expressed concern about appropriateness of language (Figure 4-5).

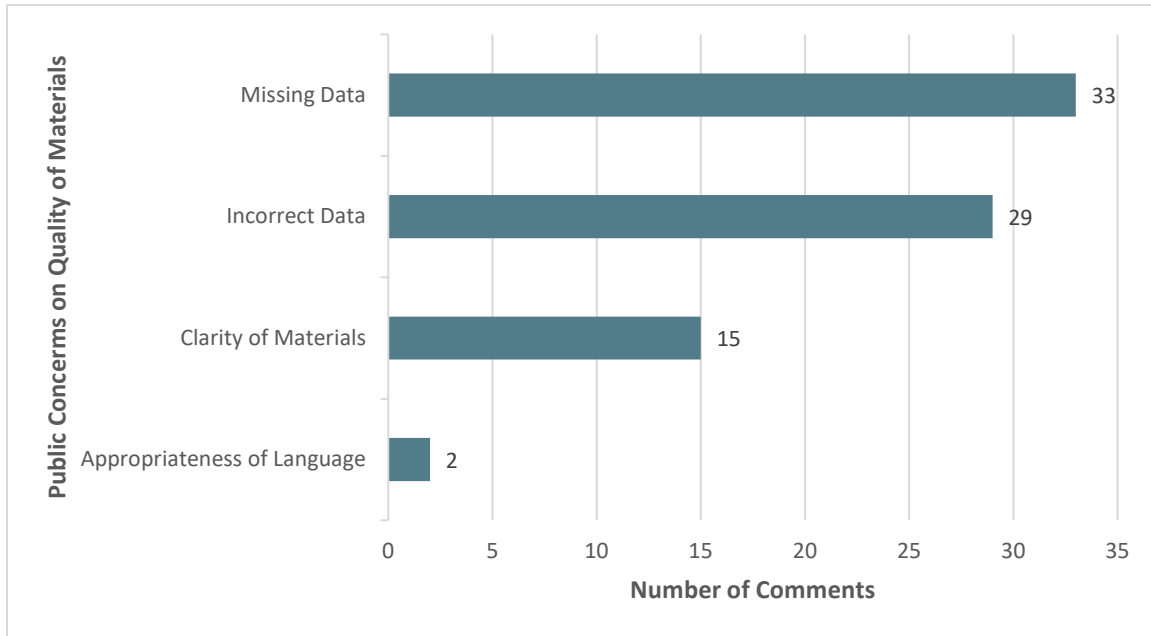


Figure 4-5. Public concerns on quality of materials.

4.2.3 Discussion of Engagement Strategies

4.2.3.1 Engagement Practices Used by the USACE Project Team

The USACE project team organized public comments in a table, and longer comments (more than 1–2 paragraphs) were broken out into multiple lines to allow for more targeted response. Responses were targeted and generally addressed the root of a comment or concern, and either provided a solution or pointed to a potential future solution. If USACE disagreed with a comment or concern, evidence was provided to refute the claim and provide an explanation.

4.2.3.2 Future Opportunities for Innovative Engagement Strategies

Public engagement for this case study, like several other studies, relied heavily on the general public emailing comments or attending public meetings hosted by USACE. While both opportunities are important vehicles for receiving public comments, outreach and engagement could expand so that the community within the benefit area or impact area is well represented—not only by people who have the time to submit email comments or attend a single meeting. Across several districts and different types of projects, there are many instances where, leading up to feasibility studies, USACE has done an effective job choosing a meeting space that is accommodating and familiar to a potentially impacted community (e.g., a centralized community center). However, USACE project teams might take this a step further and with permission and fair notice, make a coordinated effort to host shorter, but more frequent engagement activities at locations that community members already frequent like places of worship or facilities where large numbers of community members’ work.

This type of planned, targeted engagement is consistent with the expectations set by EO 14091 to “meaningfully engage with underserved communities, including through accessible, culturally and linguistically appropriate outreach, and the incorporation of the perspectives of those with lived experiences into agency policies, programs, and activities.” (EO 14091, 2023)



4.3. DISTRIBUTIONAL EQUITY ANALYSIS

4.3.1 EJ Analysis Conducted by USACE

Using both federal guidance (NEPA) and state guidance (CEQA, or California Environmental Quality Act) that was relevant at the time the study was conducted, the USACE project team summarized the racial and ethnic distribution and 5-year income estimates of the study area using data collected by the U.S. Census Bureau, including the decennial census and the American Community Survey (ACS) and developed a construction traffic access route plan, complete transportation level of service calculations, and identified criteria pollutants.

4.3.2 Geostatistical Environmental Equity Reanalysis: Flood Risk

4.3.2.1 *Benefit Area Boundary Delineation*

The FRR benefit area boundary for the environmental equity reanalysis is the same boundary used for the flood damage modeling domain in the USACE feasibility study; referred to as the Economic Impact Analysis (EIA) boundary. The study team developed population-weighted centroids for each census block (for race and ethnicity) and for each census block group (for poverty status) that fell either partially or fully within the benefit area.

Population-weighted centroids more accurately represent population distribution within the census geography and were used to account for edge effects when determining whether a census block or block group would be included in the benefit area. In the case of the South San Francisco Bay Shoreline study, creating population-weighted centroids was critical to eliminating industrial census blocks where the population exists outside the reanalysis benefit area boundary.

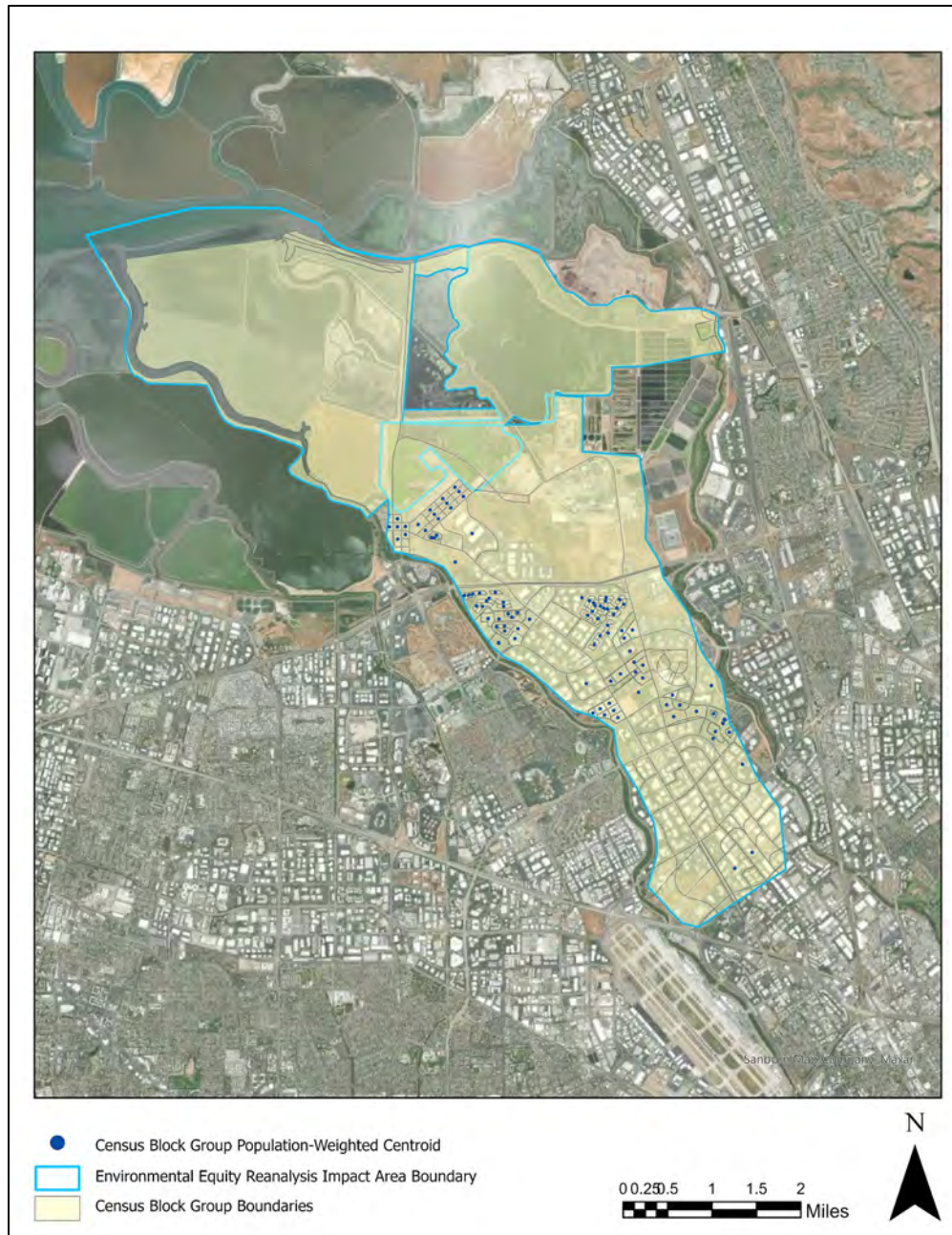


Figure 4-6. Boundaries used for geostatistical environmental equity reanalysis: FRR benefits.²

² Note: For this study and all case studies, boundaries used for the distributional equity analysis and the equity weighted BCA are one in the same. The only difference involves the census units used for each. For the distributional equity analysis, the study team used census blocks for race and ethnicity and census block groups for poverty status. For the equity weighted BCA, the study team used census block groups for median household income and per capita income.



4.3.2.2 Results by Population Characteristics: Flood Risk Reduction Benefit Area

The odds ratios presented in this section indicate the likelihood that a specific population group will reside within the FRR area, as opposed to within the larger reference area (the county) and therefore have a greater likelihood of experiencing benefits from the proposed project. Figure 4-7 below demonstrates odds ratios for race/ethnicity and income at the block level. In this instance, the FRR benefit area's Asian, Hawaiian, and Black populations are more likely to reside within the area shown above in Figure 4-6, and therefore are more likely to experience potential disproportionate benefits. Notably, the Asian population is more than two times more likely to reside inside the area.

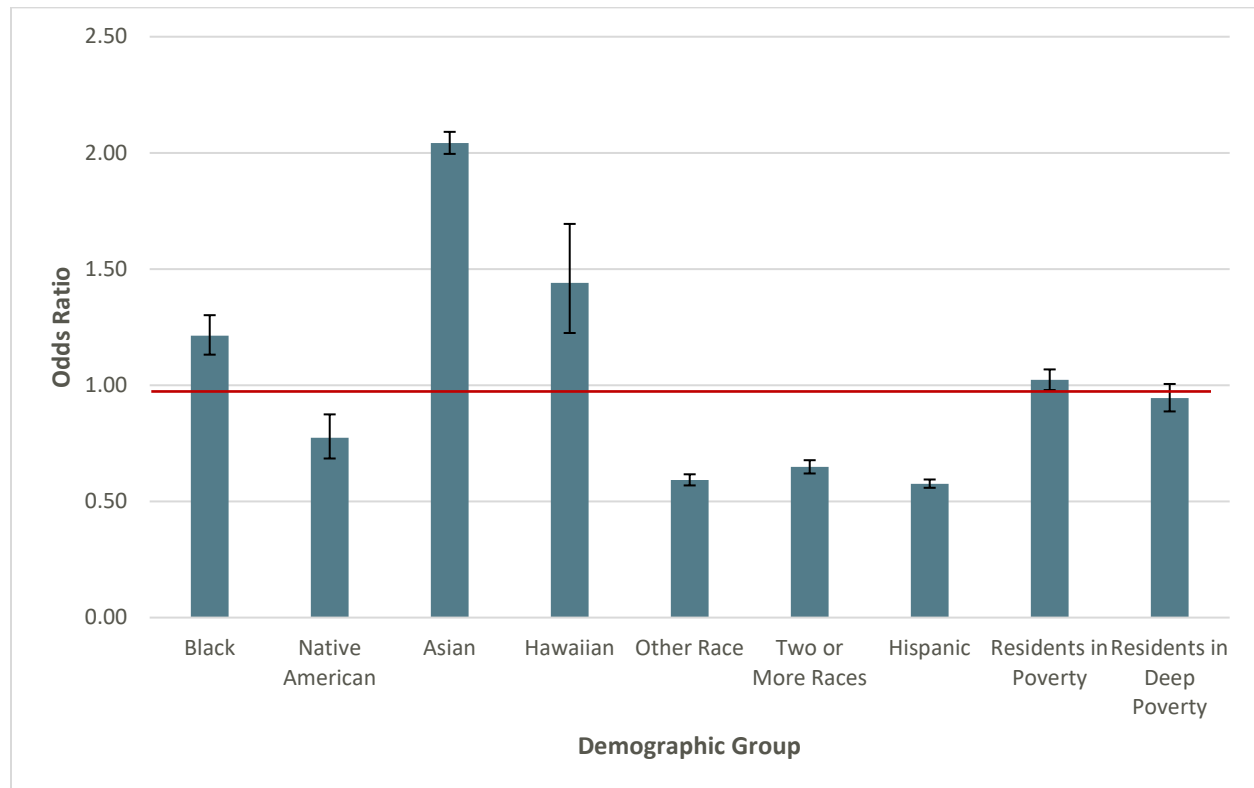


Figure 4-7. Odds ratios demonstrating the likelihood of demographic groups living inside the FRR benefit area. The whiskers around each odds ratio in the figure represent 95% confidence intervals on the odds ratio. Only values for which the 95% confidence interval does not contain 1.00 are discussed in the text.

4.3.3 Geostatistical Environmental Equity Reanalysis: Construction

4.3.3.1 Impact Area Boundary Delineation

The construction impact area boundary for the environmental equity reanalysis was developed by creating a 0.5-mile buffer around the truck routes identified by USACE in the feasibility study. This distance corresponds with the default isolation distance established by the USDOT in the event of a fire involving a tank truck (USDOT, 2020). The study team developed population-weighted centroids for each census block (for race and ethnicity) and for each census block group (for poverty status) that fell either partially or fully within the construction impact area boundaries. Figure 4-8 highlights the area's population density within census blocks and the buffer area in general, demonstrating that most residents living in these buffer areas are located along the edges.

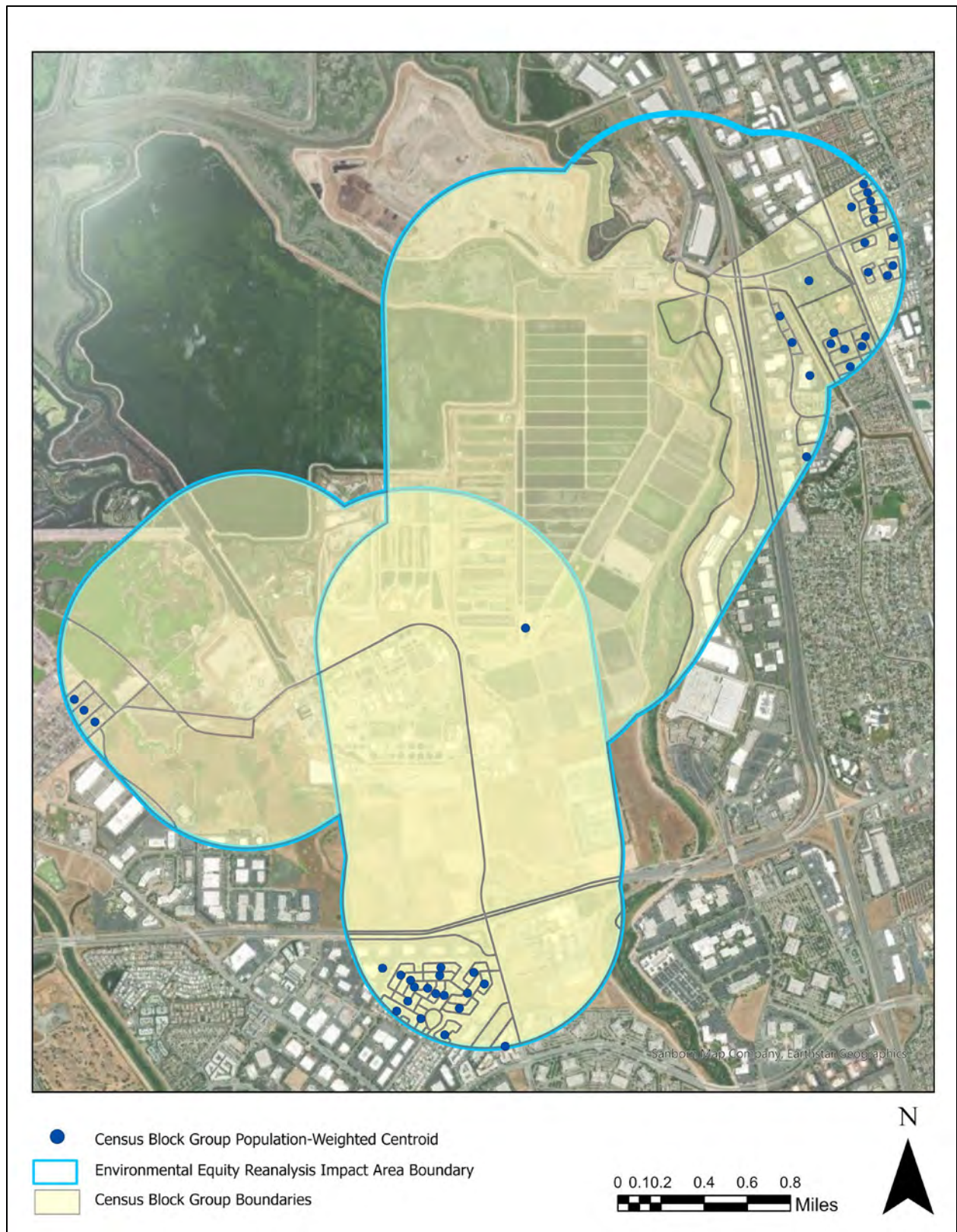


Figure 4-8. Boundary used for geostatistical environmental equity reanalysis: truck route buffer.



4.3.3.2 Results by Population Characteristics: Construction Impact Area

In this section, the odds ratios indicate the likelihood that a specific population group will reside within this impact area, as opposed to the larger reference area (Santa Clara County), and may disproportionately experience negative impacts from increased truck traffic during project construction. Figure 4-9 demonstrates odds ratios for race/ethnicity at the census block level and income at the census block group level within the construction impact area. In this instance, the impact area's Asian and Hawaiian populations are more likely to reside within the construction impact area shown above in Figure 4-8. Notably, the Asian population is more than 2.5 times more likely to reside inside of the construction impact area, and the Hawaiian population is more than 1.5 times more likely. This signifies that these groups would potentially experience disproportionate negative impacts when compared to the larger reference area.

Residents living in both poverty and deep poverty are less likely to live within the construction impact area boundary, with odds ratios of 0.29 and 0.26 respectively. These values demonstrate that these groups are less likely to experience potential disproportionate negative impacts from increased truck traffic during project construction.

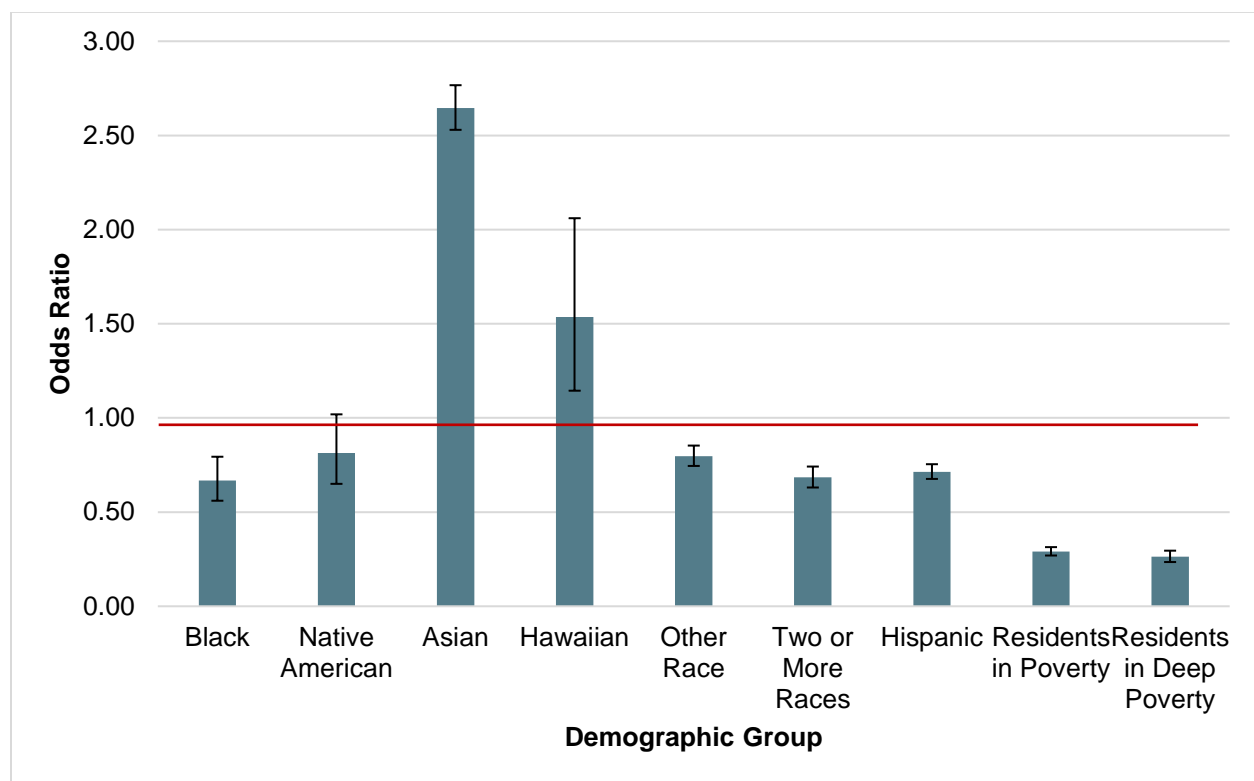


Figure 4-9. Odds ratios demonstrating the likelihood of demographic groups living inside the construction impact area. The whiskers around each odds ratio in the figure represent 95% confidence intervals on the odds ratio. Only values for which the 95% confidence interval does not contain 1.0 are discussed in the text.



4.4. ANALYSIS OF EQUITY WEIGHTING IN BCA

4.4.1 Preceding BCAs

4.4.1.1 Original Project BCA

In the 2015 feasibility study (USACE, 2015a), USACE measured FRR via levee improvements for multiple different levee heights across three different modeled degrees of sea level rise. Benefits and costs were calculated for both the LPP and the NED plan.

4.4.1.2 2023 Reanalysis

In the 2023 report that explored the potential for measuring natural and nature-based features (NNBF) for South San Francisco Bay (Fischbach, Dalyander, McHugh, et al., 2023), the study team did not add any additional benefits for the project. The following section focuses only on the benefits as originally calculated by the USACE team for the LPP.

4.4.2 BCA Calculation and Updated Benefits

The first step in the analysis was to take the overall project benefit and allocate it across block groups in the study area. The original USACE study (USACE, 2015a) did not provide a breakdown of benefits at this level of spatial resolution, so the study team applied three different assumptions: an even distribution of benefits, a weighted approach by the count of structures in each block group, and a weighted approach that uses the estimated value of structures in each block group. Income weights were then calculated for three selected reference incomes. Figure 4-10 shows how weighted benefits are affected by the choice of allocation method and reference weight. From the original benefit of \$42 million, weighted benefit decreases sharply when comparing to the national median (\$15–18 million depending on allocation method) or the state of California (\$20–24 million depending on allocation method); by contrast, comparing to Alameda County incomes generally yields higher weighted benefits because of the relatively high county income (\$41–48 million depending on allocation method).

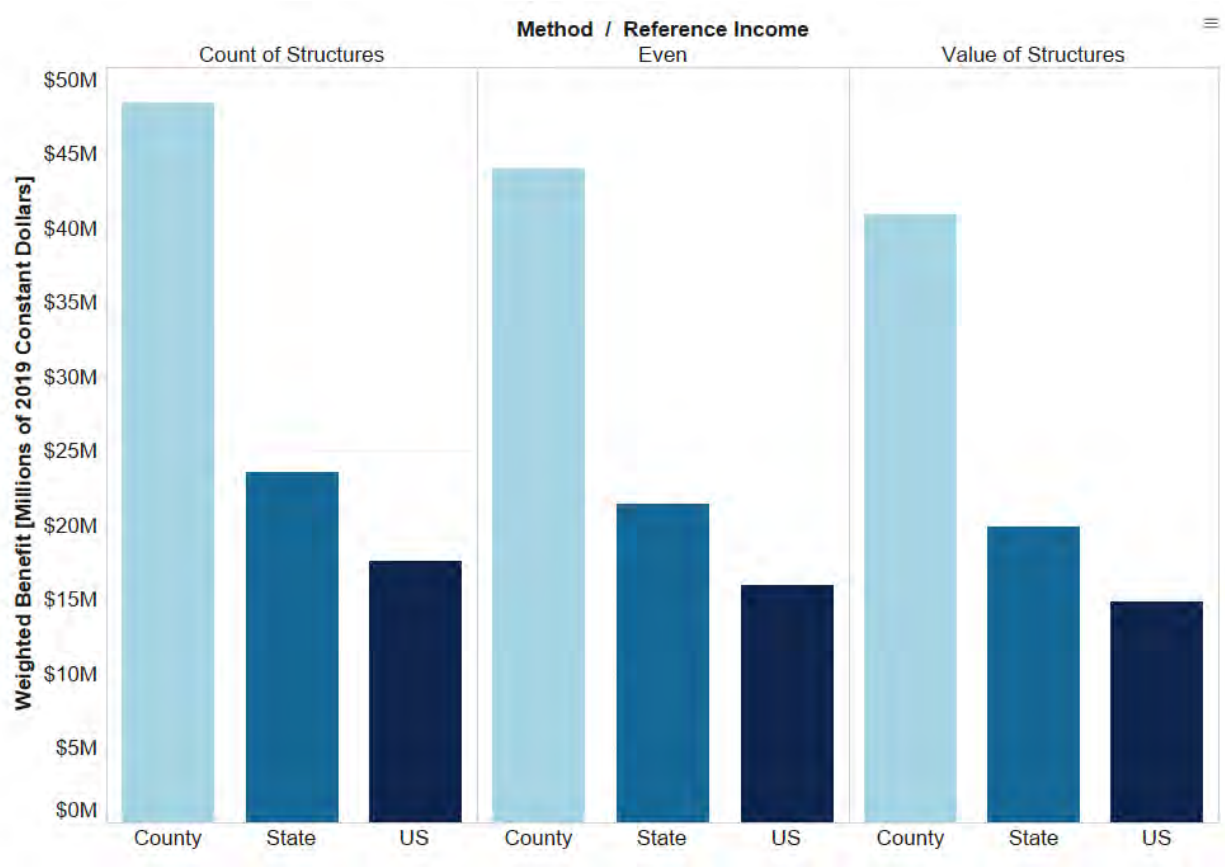


Figure 4-10. Weighted benefit by allocation method and reference income.

Highlighting the impact of the weighting approach on the spatial distribution of benefits in South San Francisco Bay, the first pane of Figure 4-11 (reading from left to right) shows the initial distribution of benefits allocated by the count of structures in each block group. The second pane shows the distribution of weights, calculated using block group income compared to state income as a reference point. The final pane shows the resulting weighted benefit from multiplying the initial benefits and weights.

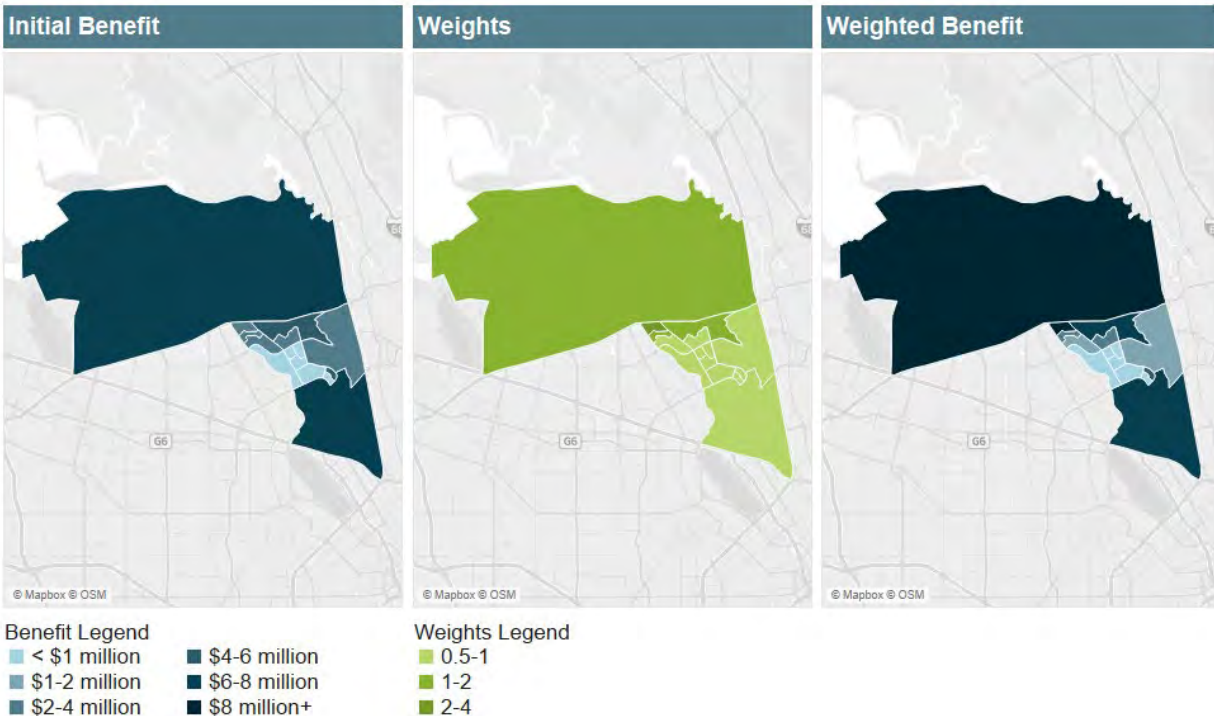


Figure 4-11. Spatial distribution of benefits and weights by block group.

Note that the spatial distribution does not significantly shift from the initial to income-weighted benefits. The weights across the census block groups do not show much variation, and this lack of variation in weights leads to an overall pattern of weighted benefits that has not shifted far from the original set of benefits. Notably, only one of the block groups has a weight above one with the state reference income.

In general, the choice of allocation approach and reference income can also make a substantial difference in the spatial distribution of benefits (Figure A-8). When viewing weighted benefits mapped by block group for all nine combinations of allocation approach and reference income considered in this analysis, weights fall sharply for all block groups as reference incomes decrease from the county to the state level, before falling less dramatically for all block groups when the reference income is set to the US level. Notably, due to the method of calculation, the effect is not uniform across different block groups: block groups with the most extreme weights (high or low) are most affected by the choice of reference income. The effect of the benefit allocation is more spatially variable. For example, the maps reveal the source of the increase in benefits for the structure count approach seems to come from allocating more benefit to the relatively highly weighted block groups along the northern part of the project area and less to the more centrally located block groups with lower weights.

The next section brings together weighted benefit and cost and compares against the original BCA calculation.

4.4.3 Weighted BCA Recalculation

The original USACE BCA combined costs and benefits into two BCR values, one based on the project year water resources discount rate of 3.375% and one based on the OMB discount rate of 7%. The costs



and benefits expressed as average annual equivalents (AAEQ) and the BCR for these two discount rates for the 15.2-foot levee in the high sea level rise condition can be found in Table 4-2. In addition, Table 4-2 contains cost, unweighted benefit and BCR recalculated using a 2% discount rate. The effect of lowering the discount rate is to lower AAEQ cost and thus raise the overall project BCR as compared to the values used in the original USACE analysis.

The same set of calculations was then performed using the weighted benefits (specifically, the weighted benefits derived from the count of structures allocation method and the county reference income). These values can be found in Table 4-3.

Table 4-2. BCA values for the original study benefits for three different discount rates. All dollar values in millions of constant 2015 dollars.

	Water Resources (3.375%)	OMB 1992 (7%)	OMB 2024 (2%)
Benefit AAEQ	\$42.1	\$42.1	\$42.1
Benefit NPV	\$1,011	\$581	\$1,324
Cost AAEQ	\$4.5	\$7.8	\$3.0
Cost NPV	\$107	\$107	\$109
BCR	9.39	5.43	12.06

Table 4-3. BCA values for the weighted benefits for three different discount rates. Values in parentheses represent the upper and lower bound across all assumptions about allocation and reference income. All dollar values in millions of constant 2015 dollars.

	Water Resources (3.375%)	OMB 1992 (7%)	OMB 2024 (2%)
Benefit AAEQ	\$23.5 (\$14.9–\$48.4)	\$23.5 (\$14.9–\$48.4)	\$23.5 (\$14.9–\$48.4)
Benefit NPV	\$563 (\$356–\$1,161)	\$324 (\$205–\$668)	\$736 (\$467–\$1,521)
Cost AAEQ	\$4.5	\$7.8	\$3.0
Cost NPV	\$107	\$107	\$109
BCR	5.24 (3.31–10.79)	3.03 (1.92–6.24)	6.72 (4.25–13.95)

4.4.4 Discussion

The South San Francisco Bay project highlights the importance of the choice of reference income in calculating of equity weights. Using the US national income or even the state income as the reference income results in sharply lowered benefit, despite California having a relatively high median income across all states. The benefits only increase when the county income is used as the reference, indicating that the project area is composed of census block groups with relatively lower median household income for the county, though in Alameda County “lower” household income is quite high relative to the rest of the country. This case study raises important questions about how to account for poverty amidst the variability of income across and within states.



5.0 WEST SACRAMENTO

5.1. INTRODUCTION

5.1.1 Study Area

The West Sacramento Study Area (Figure 5-1), located in Yolo County, California, is positioned downstream of the Sacramento River Watershed and is prone to major flooding. The area depends on levees to protect over 50,000 residents and its infrastructure, and there is significant risk associated with potential levee failures resulting from seepage, instability, proximity to the river, and development. The *2015 West Sacramento General Reevaluation Report* was authorized to improve, strengthen, raise, replace, or rebuild levees as needed (USACE, 2016c) .³

5.1.2 Demographics

In the West Sacramento FRR benefit area, the three largest racial groups include people identifying as White (47.2%), Two Races (16.6%), and Other (14.6%). A total of 32% of residents living in the FRR benefit area identify as Hispanic. A higher percentage of Black residents, Native American residents, and Hawaiian residents live inside the FRR benefit area than outside (Table A-3).

5.1.3 Final Alternative

The final alternative, known as Alternative 5, included actions to improve levees by addressing seepage, stability, and erosion concerns identified for the Sacramento River North and South, Yolo Bypass, DWSC east and west, Port South, and South Cross levees (Figure 5-2). These actions included raising the levee in place, waterside armoring bank protection, building of slurry walls, two channel closure structures, and a 30,000 feet long setback levee along the Sacramento River.

³ See (Fischbach, Dalyander, McHugh, et al., 2023), chapter 6, for more background information on this case study.

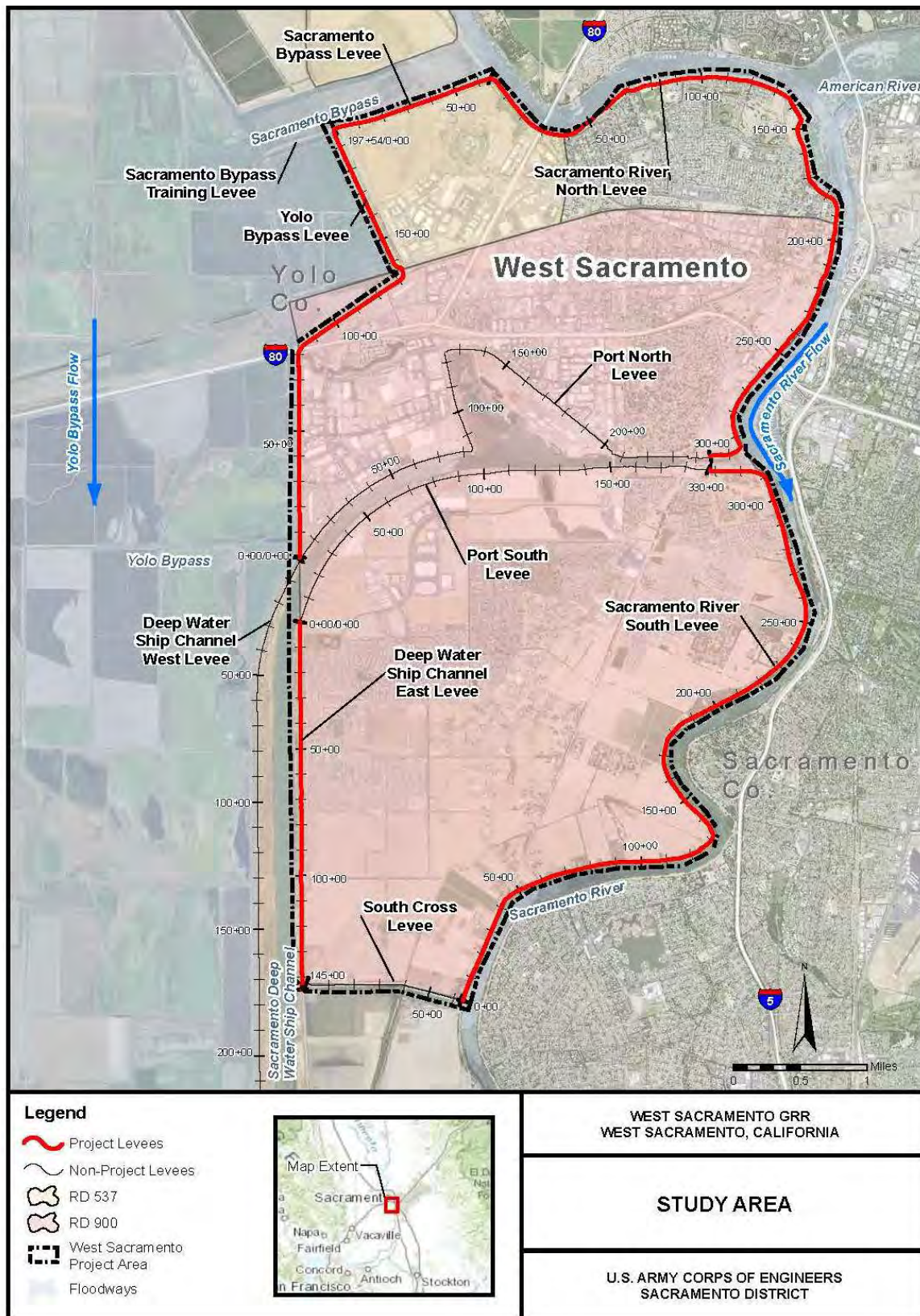


Figure 5-1. Study area: West Sacramento (West Sacramento Project General Reevaluation Report, 2015).

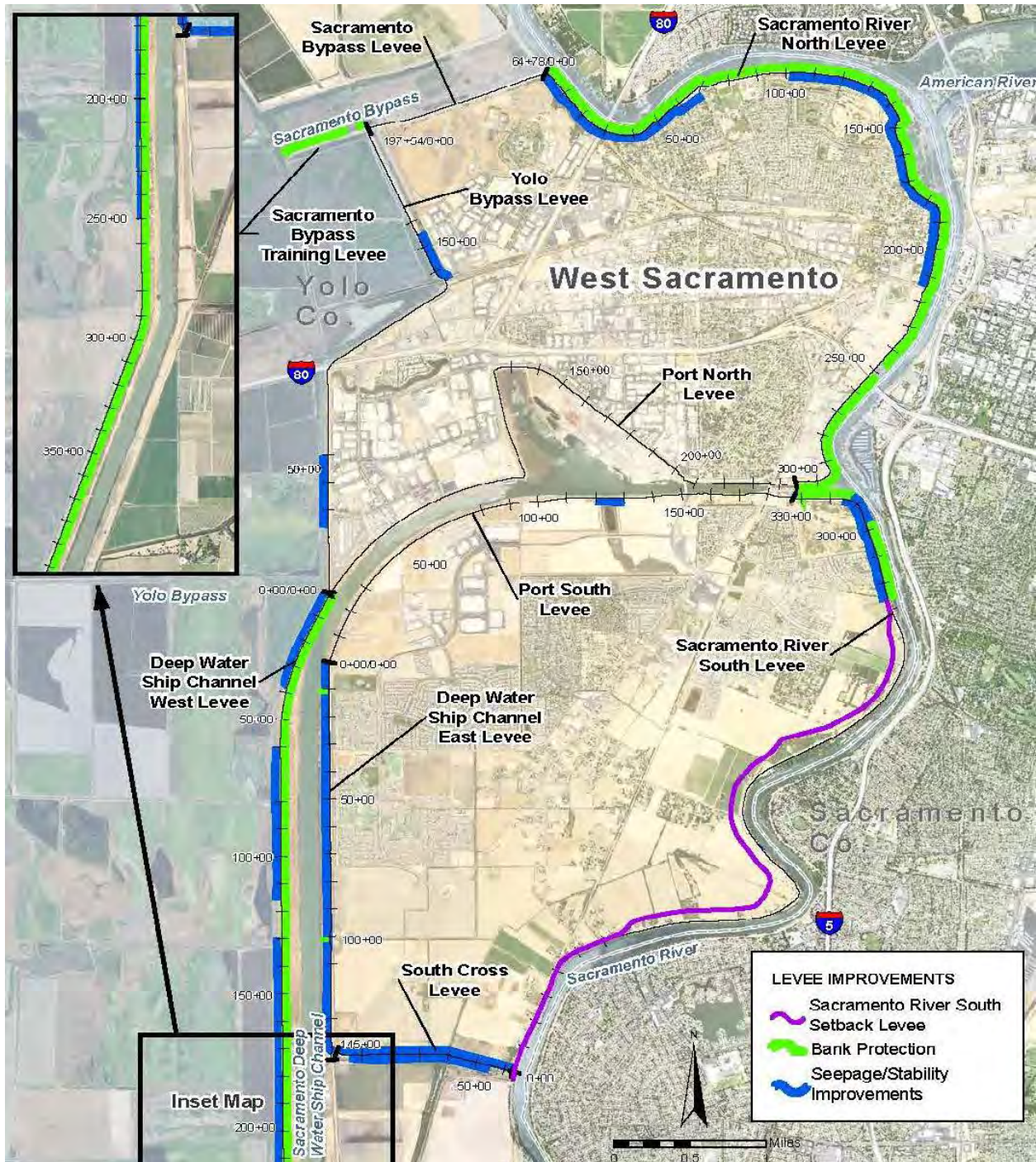


Figure 5-2. West Sacramento General Reevaluation Report final alternative (Alternative 5) (West Sacramento Project General Reevaluation Report, 2015).



5.2. PROCEDURAL EQUITY ANALYSIS

5.2.1 Analysis of Stakeholder Engagement

5.2.1.1 Scoping Process

Scoping for this study began in 2009, when the USACE project team invited the public to review the preliminary reconnaissance study findings and offer input—particularly related to environmental concerns. That same year, USACE also held a series of public workshops to elicit community feedback on the project. Additionally, a public meeting was held to inform stakeholders about the *West Sacramento General Reevaluation Report (GRR)* (*West Sacramento Project General Reevaluation Report, 2015*) and gather more feedback about the proposed scope.

In 2014, USACE circulated the draft GRR for public comment and conducted two additional workshops during the public comment period on both the draft GRR and the draft EIS/EIR, where they received 55 comments.

5.2.2 Review of Public Comments

5.2.2.1 Stakeholder Comment Trends

The majority of stakeholder comments on both the West Sacramento Project GRR and EIS/EIR came from the general public (63%), though many came from representatives of state government (13%) and NGOs (16%), as seen in Figure 5-3. Due to the nature of public comments being either anonymous or simply attached to a name with no other identifying information, reviewing comments by “type of stakeholder” is primarily useful in identifying underrepresented groups of stakeholders and planning to target these groups more strategically throughout the rest of the project’s lifecycle.

If USACE were to collect census-type information from commenters related to geographic location, race or ethnicity, and/or income level and offer the option of anonymity, these characteristics could be installed in qualitative coding software as sub-codes, and the data could be used to identify relative representation in engagement activities. This information could help USACE measure effective engagement in real time, and more flexibly adjust the course of engagement throughout project planning and review processes as needed.

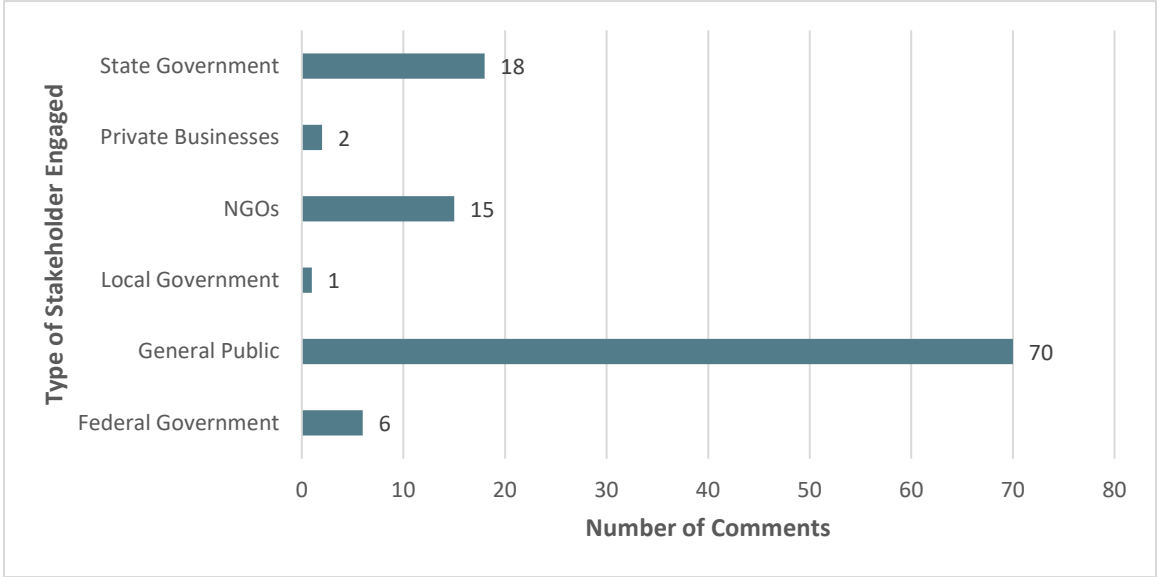


Figure 5-3. Types of stakeholder comments.

Comments on the draft report were largely made via email (76%). The rest were provided at public meetings.

USACE responded to each comment—noting where adjustments had been made—and recorded the responses in the report appendices (Figure 5-4).

Page 14: Inserted	L2PDRDFA	8/10/2015 4:22:00 PM
The finalized document, and all comments received in the final review, will also be used to prepare the Record of Decision (ROD) for the NEPA lead agency		
Page 14: Inserted	L2PDRDFA	8/10/2015 4:24:00 PM
, In the case of the West Sacramento Project the ROD would be signed by the Assistant Secretary of the Army for Civil Works		
Page 14: Inserted	L2PDRDFA	8/10/2015 4:26:00 PM
-		
Page 14: Comment [DFA13]	L2PDRDFA	8/18/2015 10:58:00 AM
Not sure if you want to add anything for CEQA.		
Added CEQA information		
DFA BACKCHECK: Comment closed.		
Page 23: Comment [DFA14]	L2PDRDFA	8/18/2015 10:59:00 AM
I don't think overtopping is a measure or alternative. Suggest simply calling the measure Raising Levees instead.		
Changed to raising levees		
DFA BACKCHECK: Comment closed.		

Figure 5-4. Organization of USACE response to public comments on West Sacramento Project General Reevaluation Report (USACE, 2015b).



5.2.2.2 Examples of Public Concerns

One major concern reflected in public comments was the perceived ecological costs of the proposed project alternatives. While 4 comments reflected perceived ecological benefits, 21 comments were related to perceived ecological costs.

Most of the comments tagged as perceived ecological costs were related to the levee projects proposed in Alternative 2 and the potential impacts that levee construction would have on habitat, farmland, real estate, wildlife, and native plants.

Table 5-1. Examples of segments extracted by USACE of comments coded as "Perceived Ecological Costs". (USACE, 2015b).

Segment
<p>My entire family has been on these lands for more than 100 years farming, raising families, and passing the land and homes on to the next generation. As has been done for several generations, a portion of this land was handed down to me, to build a home (constructed in 2004) and to raise a family. My children, ages six and eleven, will be the sixth generation to receive the land and homes upon which we currently live. We have organic gardens, horses and goats, small pets, raise chickens for eggs, raise cattle for meat, and have planted and cared for hundreds of fruit trees and more than 75 native and non-native oak trees.</p>
<p>On our home site, there is a vast array of wildlife that will be destroyed when ANY levee improvement is made. Snakes, gophers, hummingbirds, fox, coyote, turkey, turtles, pheasant, the list literally could go on and on.</p>
<p>It is of the utmost importance, that the impending levee improvements be constructed in a way that has the least impact to our homes, families and properties. Please know we are supportive of improving the levees, however the excessive taking of private property in a setback levee scenario as proposed in Alternative 2 is absurd. It is clear the intent is to construct setback levees because the additional funding source will be substantial with this type of improvement. Setback levees should not be the answer. They are expensive from a land acquisition perspective, require the ripping out and then replacing of habitat to the detriment of any living thing in its path, and require enormous state, federal, and local funding efforts. A setback levee is the least favorable option, as it imposes the greatest harm to the residents, farm land, cultures, future generations, and to the beauty and character of the area.</p>
<p><i>The setback levee will destroy family homes, disrupt animal habitats (already living along the river) and destroy agricultural lands. It saddens me to think the Army Corp of Engineers and the W. State Area Field Based Agency could consider destroying all of these things.</i></p> <p><i>I know that alternative levee improvements can be done without destroying homes and farms. I live on Linden Rd and believe a sturpy wall is being constructed north of my home. A sturpy wall through the middle of the existing levee south of Linden Rd (captured into the soil 100 feet) isn't impossible, keeping our families & wildlife in their homes. Please consider improving the levees without destroying our beautiful & peaceful country views. Thank you.</i></p> <p><i>Shirley L. Linn</i></p> <p style="text-align: right;">126</p>



5.2.2.3 Public Concerns About Engagement

Of the comments related to public concerns about engagement, the majority referred to a lack of communication. Commenters expressed concern that few notices were sent out related to the homes and land that were being threatened in order to accommodate FRR projects. Additionally, the public were concerned that many residents did not receive any sort of notice and therefore were unaware of the project. One commenter expressed frustration about being given vague information.

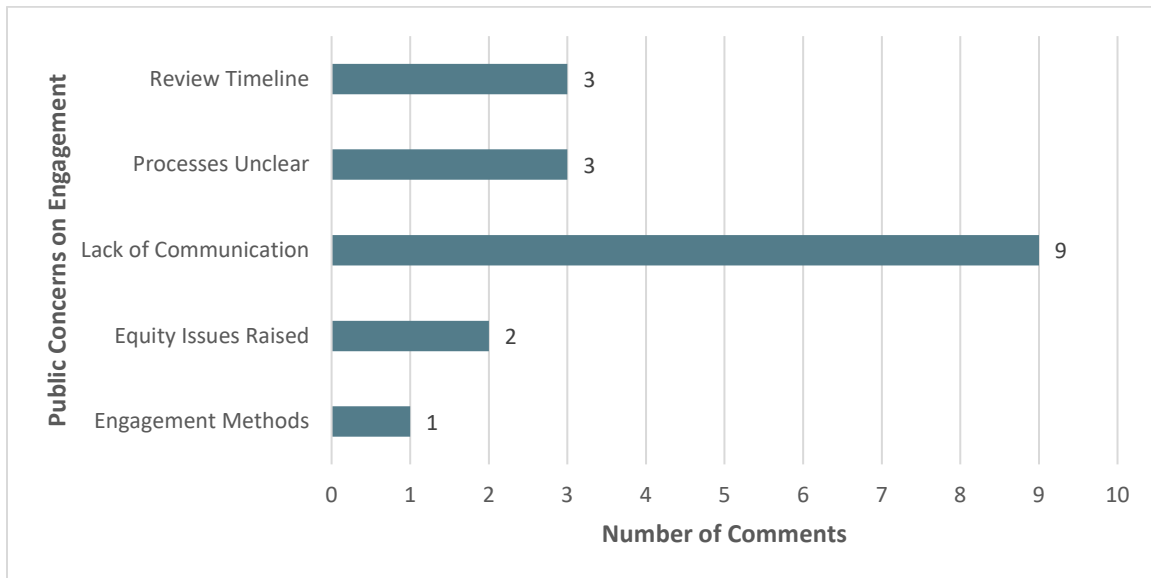


Figure 5-5. Public concerns on engagement.

There were 42 comments that discussed the quality of materials provided in the draft Integrated Report. Of those comments, the majority (81%) were requests for additional information (Figure 5-6). This finding highlights the value of qualitative coding and analysis of public comments, as such requests for additional information have the potential to increase efficiency in the editing process that takes place between the draft and final GRR.

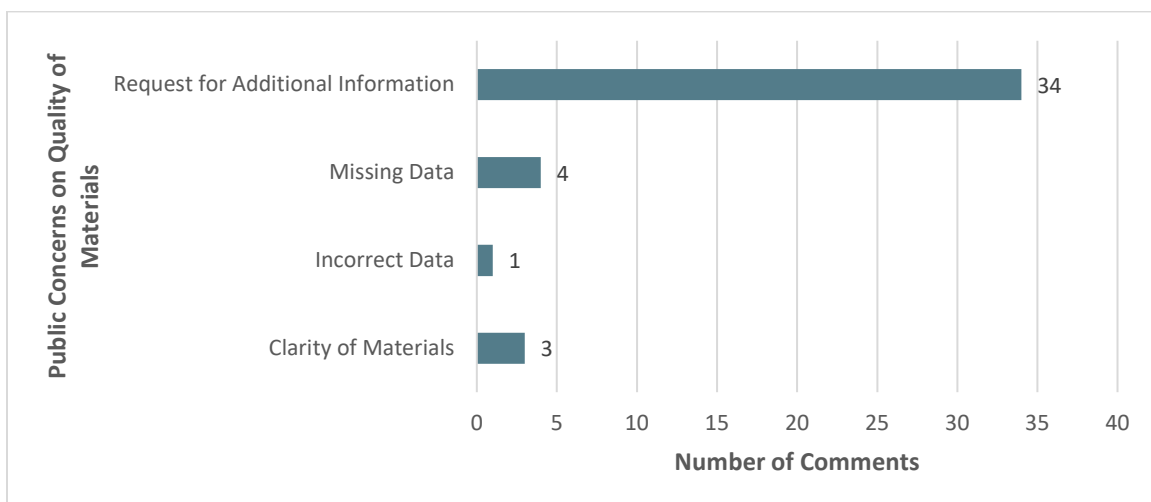


Figure 5-6. Public concerns on quality of materials.



5.2.3 Discussion of Engagement Strategies

5.2.3.1 Engagement Practices Used by the USACE Project Team

USACE’s engagement efforts at the time of project authorization were aligned with the agency guidance that existed at that time, and the USACE project team used the best available data to plan for and execute inclusive public meetings and workshops throughout the scoping and review phases.

5.2.3.2 Future Opportunities for Innovative Engagement Strategies

If this study were to be conducted under more recent guidance from EO 14008 (Executive Order No. 14008, 2021), there could be additional opportunities to “actively encourage and solicit community-based science and Tribal ecological knowledge” and create opportunities for underserved and marginalized communities to engage in “meaningful participation on the development and design of research strategies undertaken (Executive Order No. 14008, 2021).” Using qualitative data analysis software to code comments received in public meetings and in response to draft documents could allow for more organized, quantitative aggregation, and provide insights that might be otherwise missed during the very thorough and necessary, but highly siloed response to individual comments.

Furthermore, formatting public comment cards to include specific census-type questions could demonstrate whether engagement has been “meaningful” and could inform more targeted, future project-related engagement. At a minimum, the collection of the ZIP codes of commentors could allow USACE to broadly characterize the demographics of respondents and adjust subsequent engagement activities. For instance, if after the first public scoping meeting a certain group within the project area is underrepresented, efforts can be made to compensate for this imbalance before the next meeting is held. For example, the project team might reach out to specific community groups to more strategically promote the next meeting or utilize the CEJST tool or a more granular spatial ID method, such as dasymetric mapping, to determine where the next meeting could be held to increase participation from underrepresented groups.

5.3. DISTRIBUTIONAL EQUITY ANALYSIS

5.3.1 EJ Analysis Conducted by USACE

Following federal, state, and local laws, regulations, and policies that existed at the time this study was conducted (NEPA/CEQ guidelines, Uniform Relocation Assistance and Real Property Acquisition Policies Act, EO 12898, California Code Chapter 16: Relocation Assistance, the City of West Sacramento General Plan, and the Yolo Countywide General Plan), USACE assessed existing conditions related to the study area, population, demographics, employment, income, and poverty. Though it was determined that the project would not have a significant EJ or socioeconomic impact on the community and therefore required no mitigation measures, a consideration of cumulative impacts was also required. The USACE project team assessed cumulative impacts by examining various projects in and near the Sacramento area that could cause significant positive or negative consequences. These effects were compared against those of proposed alternatives to gauge their duration, type, and severity.

Addressing notable cumulative impacts might involve adjusting the timing of project activities and implementing alternative technologies to ensure regulatory compliance. Cumulative impacts (both positive and negative) were found for agriculture in the region, air quality during construction, cultural



resources, recreation, fisheries resources, visual resources, utilities, and certain species. No cumulative impacts were identified for water quality, transportation, climate change, or noise. It was identified that cumulative impacts to vegetation and wildlife would be less than significant once all the mitigation and compensation plantings had matured to the level of those removed.

5.3.2 Geostatistical Environmental Equity Reanalysis

5.3.2.1 Impact Area Boundary Delineation

Impact area boundaries for the environmental equity reanalysis were determined first by applying the USACE-delineated study area boundary for the project, and then by creating population-weighted centroids for each census block (for race and ethnicity) and for each census block group (for poverty status) that fell either partially or fully within the study area. Because of the nature of the decennial census and the ACS, the finest scale of data for race and ethnicity is at the block level and the finest scale of data for income-related variables is at the block-group level.

These centroids were then used to determine whether a census block or block group would be included in the impact area. More simply, the process of determining population-weighted centroids was conducted to account for edge effects (e.g., it allows for the removal of census blocks or census block groups from the analysis whose center of population resides outside the impact area). In the case of West Sacramento, this is a critical step because of the rural census blocks and block groups that contain mostly agricultural land and smaller clusters of residences that are, in some cases, located miles apart from one another.

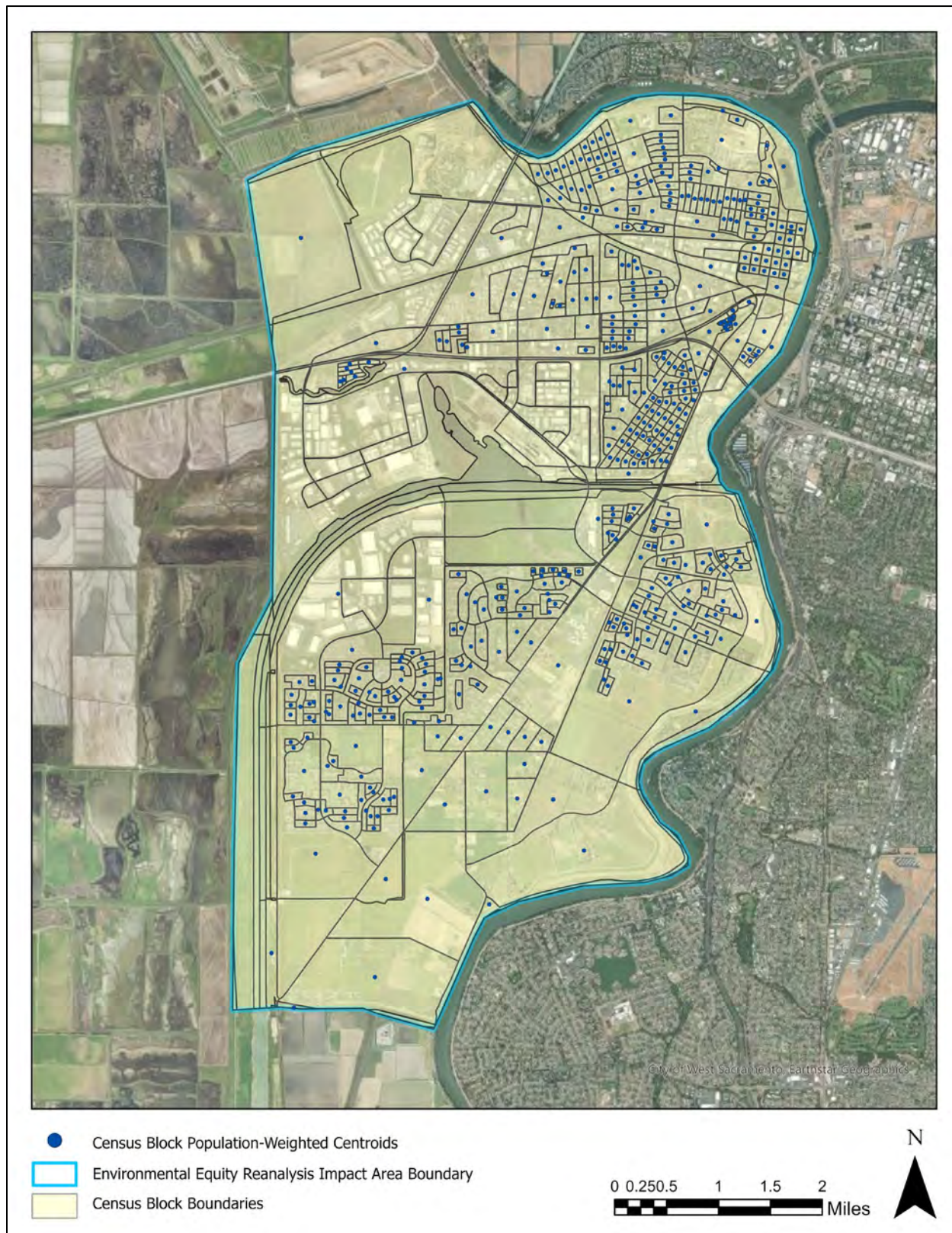


Figure 5-7. Boundaries used for geostatistical environmental equity reanalysis.



5.3.2.2 Results by Population Characteristics

Odds ratios indicate the likelihood that a specific population group will reside within the FRR study area, as opposed to within the remainder of larger reference area (Yolo County) and could therefore benefit from the proposed project. Figure 5-8 below shows odds ratios for race/ethnicity at the census block level and income and income at the census block group level. An odds ratio of one indicates that the racial or ethnic group is as likely to reside in the FRR study area as they are to reside outside of it. Black residents are 2.38 times more likely to reside within the FRR study area and benefit from the project compared to all Black residents in Yolo County. Residents identifying as Hawaiian are nearly 3.5 times more likely to benefit from the project (Figure 5-8).

By contrast, residents living in deep poverty are less likely to live inside the FRR study area, with an odds ratio of 0.55. Understanding that residents in poverty are less likely to benefit from FRR projects in this area can provide insight into how the development of boundaries and the geophysical constraints on boundary delineation can result in benefits for certain groups (e.g., the fact that West Sacramento requires a ring levee system and contains limited options for boundary delineation).

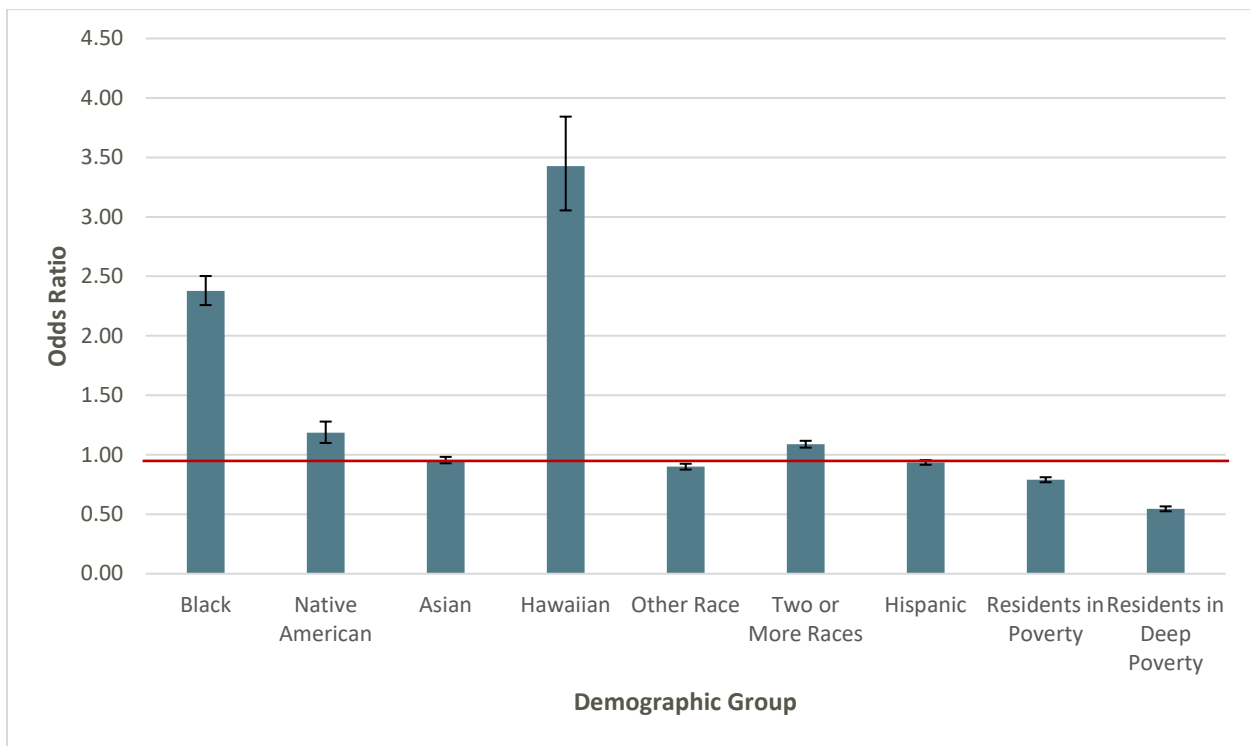


Figure 5-8. Odds ratios demonstrating the likelihood of demographic groups living inside the FRR benefit area. The whiskers around each odds ratio in the figure represent 95% confidence intervals on the odds ratio. Only values for which the 95% confidence interval does not contain 1.0 are discussed in the text.



5.4. ANALYSIS OF EQUITY WEIGHTING IN BCA

5.4.1 Preceding BCAs

5.4.1.1 Original Project BCA

In the 2015 study (*West Sacramento Project General Reevaluation Report, 2015*), USACE measured FRR via levee improvements by determining index points to model inundation levels for each of the five alternatives at each index point (eight index points total).

5.4.1.2 2023 Reanalysis

In the 2023 report that explored the potential for measuring NNBF for West Sacramento, the study team calculated ecosystem service benefits via changes in land area within the project boundaries by calculating increases in land area resulting from a setback levee alternative, and using habitat values associated with National Land Cover Database (NLCD) categories (Fischbach, Dalyander, McHugh, et al., 2023). Because the land area increases were most directly associated with low-density, moderate income census block groups within the project area, and because the ecosystem service benefits were small compared to the risk reduction effect sizes, this ecosystem services method was not carried forward in this equity reanalysis.

5.4.2 BCA Recalculation and Updated Benefits

The first step in the analysis was to take the overall project benefit and allocate it across block groups in the study area. The original USACE study (*West Sacramento Project General Reevaluation Report, 2015*) did not provide a breakdown of benefits at this level of spatial resolution, so the study team applied three different assumptions: an even distribution of benefits, a weighted approach by the count of structures in each block group, and a weighted approach that uses the estimated value of structures in each block group. Income weights were calculated relative to three reference incomes.

From the original benefit of \$264 million, weighted benefits increase across all allocation methods and reference incomes. The weighted benefits are generally lowest for the US reference income (\$264–327 million depending on allocation method), higher for the county reference income (\$315–390 million depending on allocation method) and highest for the state reference income (\$350–433 million depending on allocation method). There is some overlap between the potential ranges of benefits depending on the allocation method, which reflects uncertainty on the part of the study team about how benefits were distributed across the project area. Figure 5-9 shows how weighted benefits vary across allocation methods and reference incomes.

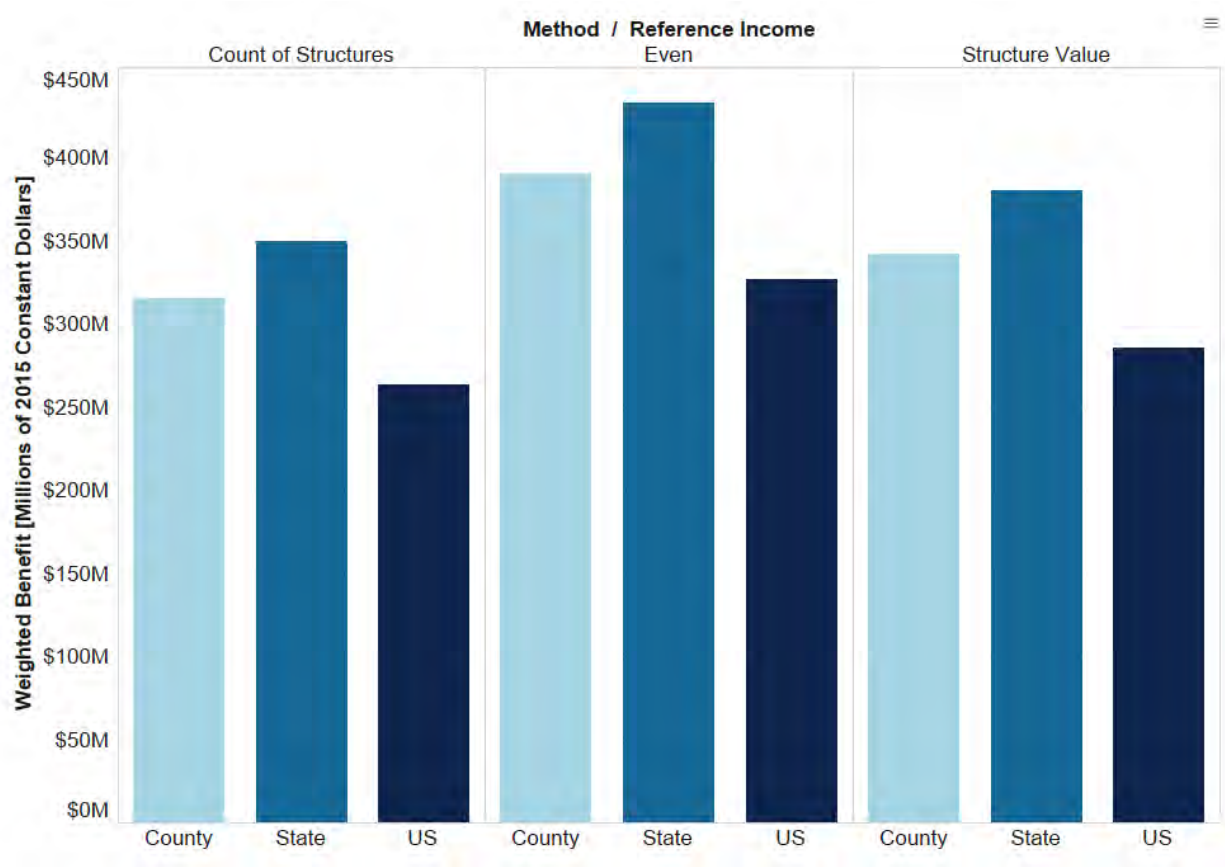


Figure 5-9. Weighted benefit by allocation method and reference income.

Showing how the weighting approach changes the spatial distribution of benefits across West Sacramento, from left to right, the first pane of Figure 5-10 shows the initial distribution of benefits allocated by the count of structures in each block group. The second pane shows the distribution of weights, calculated using block group income compared to state income as a reference point. The final pane shows the resulting weighted benefit from multiplying the initial benefits and weights.

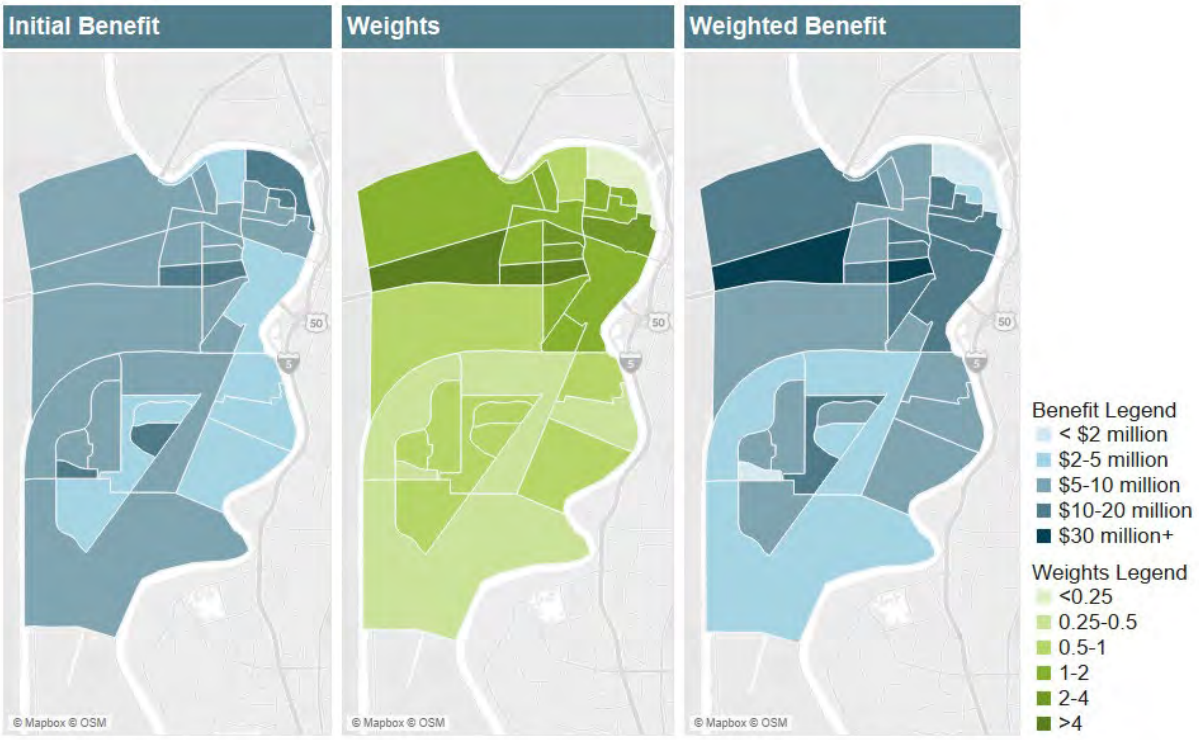


Figure 5-10. Spatial distribution of benefits and weights by block group.

Note that the spatial distribution shifts from the initial to income-weighted benefits. In particular, the more even distribution of benefits (left pane) shifts to lower-income block groups further north, with some block groups assigned weights greater than 4 that dramatically increase the resulting benefit. The pattern in the final weighted benefit map closely resembles the distribution of weights in this study area.

In general, the choice of allocation approach and reference income can also make a substantial difference in the spatial distribution of benefits. Figure A-12 shows weighted benefit mapped by block group for all nine combinations of allocation approach and reference income considered in this analysis. Weights rise slightly for all block groups as reference incomes increase from the county to the state level. By contrast weights fall more dramatically for all block groups when the reference income is set to the US level. Due to the method of calculation the effect is not uniform across different block groups: block groups with the most extreme weights (high or low) are most affected by the choice of reference income. The effect of the benefit allocation is more spatially variable. For example, the maps suggest the source of the increase in benefits for the structure value approach is from higher total structure values in the highly weighted block groups in the northeast of the project area.

5.4.3 Weighted BCA Recalculation

The original USACE BCA (*West Sacramento Project General Reevaluation Report, 2015*) combined costs and benefits into two BCR values, one based on the project year water resources discount rate of 3.5% and one based on the OMB discount rate of 7%. The costs and benefits expressed as AAEQs and the BCR for these two discount rates for Alternative 5 can be found in Table 5-2. In addition, Table 5-2 contains cost, unweighted benefit and BCR recalculated using a 2% discount rate. The effect of lowering



the discount rate is to lower AAEQ cost and thus raise the overall project BCR as compared to the values used in the original USACE analysis.

The same set of calculations was then performed using the weighted benefits (specifically the weighted benefits derived from the count of structures allocation method and the county reference income). These values can be found in Table 5-3. Note that because costs remain the same, the net effect of using weighted benefits is to increase the BCR regardless of discount rate. The most notable difference in BCR is that using the weighted benefits even under the extremely conservative OMB discount rate the study still has costs that outweigh benefits (e.g., $BCR > 1$).

Table 5-2. BCA values for the original study benefits for three different discount rates in millions of USD.

	Water Resources (3.5%)	OMB 1992 (7%)	OMB 2024 (2%)
Benefit (AAEQ)	\$264	\$264	\$264
Benefit (NPV)	\$6,198	\$3,647	\$8,304
Cost (AAEQ)	\$103	\$275	\$63
Cost (NPV)	\$2,419	\$3,806	\$1,982
BCR	2.56	0.95	4.18

Table 5-3. BCA values for the weighted benefits for three different discount rates in millions of USD.

	Water Resources (3.5%)	OMB 1992 (7%)	OMB 2024 (2%)
Benefit (AAEQ)	\$350 (\$264–\$432)	\$350 (\$264–\$432)	\$350 (\$264–\$432)
Benefit (NPV)	\$8,209 (\$6,198–\$10,153)	\$4,830 (\$3,647–\$5,974)	\$10,998 (\$8,304–\$13,603)
Cost (AAEQ)	\$103	\$275	\$63
Cost (NPV)	\$2,419	\$3,806	\$1,982
BCR	3.39 (2.55–4.19)	1.27 (0.95–1.57)	5.55 (4.18–6.86)

5.4.4 Discussion

The effect on the final benefits of the equity weighting methodology is often not enough to make a difference in the final BCR. However, when projects are on the border of being above a BCR of 1 even small increases in benefit can matter. This can be seen in the BCR for the project under the OMB 1992 discount rate, where the study as originally analyzed fell just below the point of having benefits outweigh costs (for selected values of the reference income and allocation method; USACE, 2015c). This case study also demonstrates the ability of equity weighting to redistribute income across a project area, as seen by the tendency of the equity weights to be higher in the northern part of the project area and moving benefits that way in the final weighted benefits.



6.0 SOUTH PLATTE RIVER AND TRIBUTARIES

6.1. INTRODUCTION

6.1.1 Study Area

The South Platte River, which starts in Park County, CO and flows through Denver, Brighton, and Sterling, is connected to two primary tributaries: the Weir Gulch and the Harvard Gulch. The Weir Gulch connects near Phil Milstein Park and the Harvard Gulch is located further south (Figure 6-1).⁴ The South Platte River and its tributaries are known for their important riparian, wetland, and aquatic ecosystems and recreational opportunities in an otherwise semi-arid region of the country. The river's critical habitats have been impacted by both urbanization and natural flow disruption because of river alteration. The *Adams and Denver Counties, Colorado General Investigation Study* (ADGIS) was published in 2019 to address flooding and restore important ecological habitat (USACE, 2019a).

6.1.2 Demographics

For the South Platte River and Tributaries case study, the study team delineated two different boundary areas—a recreation access benefit area and a FRR benefit area. The recreation access benefit area was based on a river access buffer boundary, and the FRR benefit area (also called the Harvard Gulch) was based on the flood damage modeling domain created by USACE for the original feasibility study (USACE, 2019a).

In the South Platte recreation access benefit area, the three largest racial groups include people identifying as White (75.6%), Two Races (9.8%), and Other (6%). Also in the recreation access benefit area, 16.8% of residents identify as Hispanic (Table A-4).

In the South Platte FRR benefit area, the three largest racial groups include people identifying as White (80.7%), Two Races (9.1%), and Asian (4.2%). Residents identifying as Hispanic in the recreation access benefit area total 9.9%. A higher percentage of Asian residents live inside the FRR benefit area than outside (Table A-5).

6.1.3 Final Alternatives

The final alternative for the South Platte River Reach was called Plan #9 and included restoration efforts in each of the five river study reaches to restore riparian, wetland, and aquatic habitat. It also reconnected existing habitat and surrounding greenspace to the South Platte River project area (Figure 6-2). The final alternative for the Harvard Gulch included a stand-alone nonstructural plan (Figure 6-3). Due to lack of spatial data, the Weir Gulch was not part of the distributional equity reanalysis or the benefit-cost reanalysis.

⁴ See Fischbach et al. (2023), Chapter 7, for more background information on this case study.

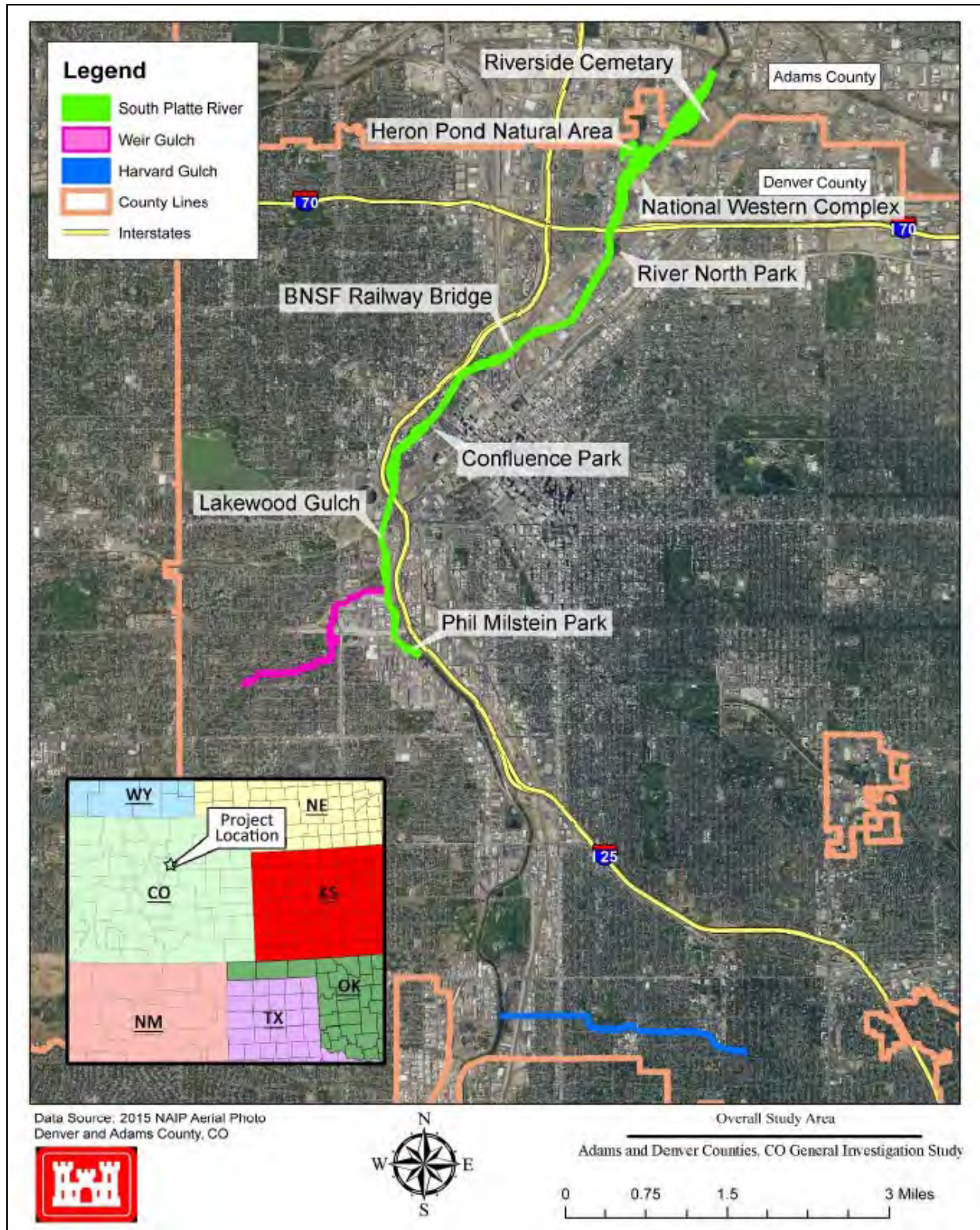


Figure 6-1. Study area: South Platte River & Tributaries.

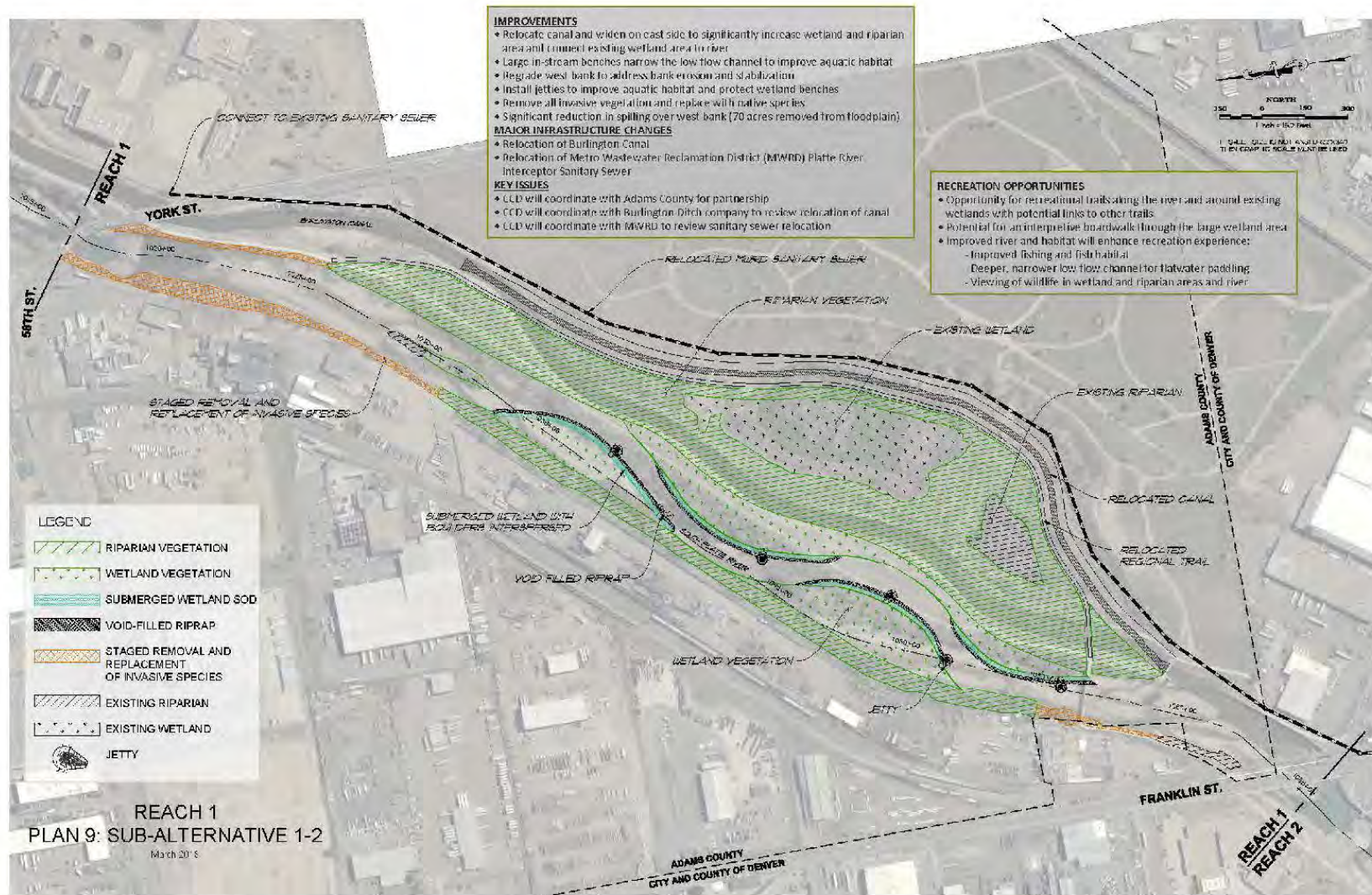


Figure 6-2. South Platte River Reach final alternative demonstrating reach 1. Note: Alternative 9 included 6 reaches, and this figure depicts the first one only (USACE, 2019a).

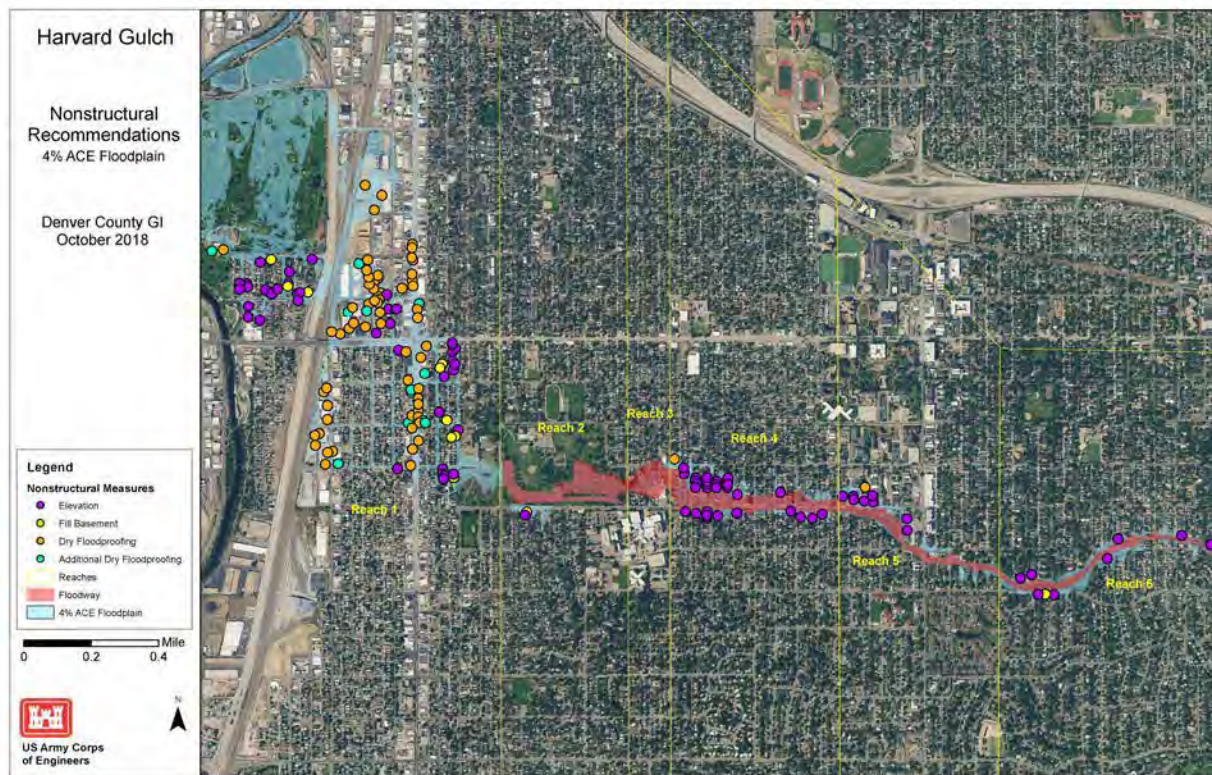


Figure 6-3. South Platte Harvard Gulch final alternative (USACE, 2019a).

6.2. PROCEDURAL EQUITY ANALYSIS

6.2.1 Analysis of Stakeholder Engagement

Covering both the river reach and the gulch alternatives, public engagement throughout the Adams and Denver County General Investigation Study (ADGIS) for both projects was extensive. In addition to holding public meetings throughout both the alternative formulation and report draft comment phases, the USACE project team and the project sponsor held a floodplain education session to provide potentially impacted homeowners. This provided homeowners with an opportunity to ask questions and get updates about a potential FEMA adoption of an updated and changed floodplain boundary that could result from the feasibility study. Meetings about specific project reaches were interactive—allowing participants to record comments and concerns on physical maps and submit questions in real time.

Extensive public engagement does not necessarily mean that potentially impacted communities were reached. At the public meetings, the USACE project team asked for address information from attendees, which could potentially help track which census blocks were represented at the meeting. This is a positive step, but collecting more information could more thoroughly track representation and allow for project teams to better understand who is being reached and demonstrate reach through maps and other visual aids.



6.2.2 Review of Public Comments

6.2.2.1 Stakeholder Comment Trends

Most stakeholder comments on the ADCGIS came from the general public (92%; Figure 6-4), and the majority were received at public meetings. Similar to findings for other case studies throughout this report, the study team noted that it could be valuable to solicit more census-type information from those who attended meetings and provided public comment to ensure proportional representation and track engagement. Such data collection could be structured to assure that names and other Personal Identifiable Information (PII) would not be gathered.

In addition to better understanding demographic representation related to the general public's comments, understanding stakeholder comments through the utilization of coding software could also allow USACE Civil Works project teams to better understand which categories of commenters were underrepresented. For instance, NGOs only account for one public comment in the *Feasibility Report and EIS Public Engagement Appendix* (USACE, 2019b). In such a situation, if this type of information were tracked at early meetings, the project team would be able to correct the course for future meetings and engagement.

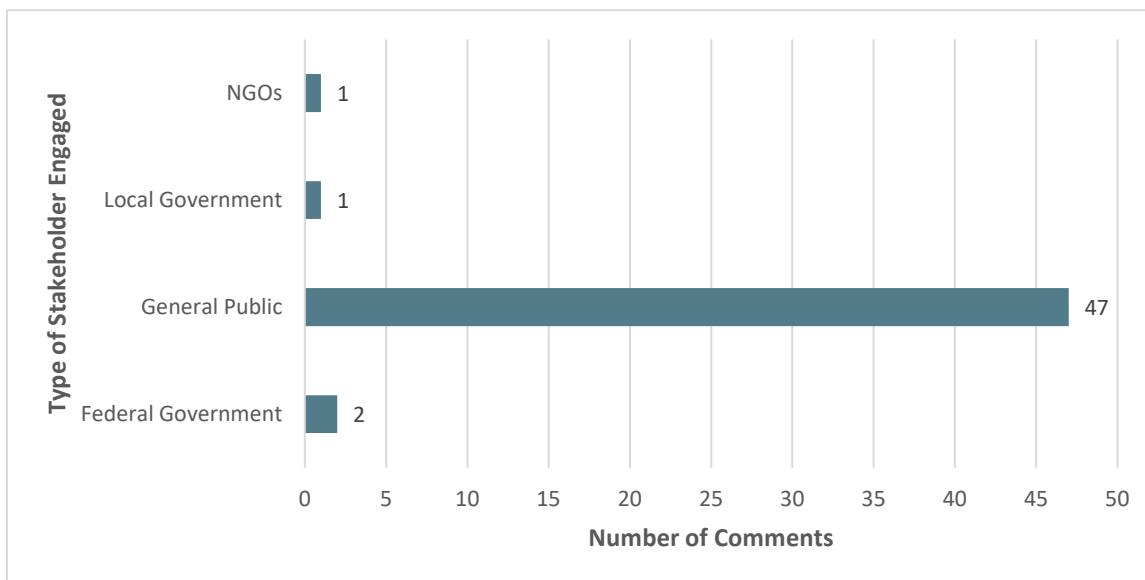


Figure 6-4. Types of stakeholder comments.

The organization of comment responses from USACE varied across different engagement activities. For questions asked aloud in real time during public meetings, thorough responses that reached the root of the question or comment were typed up and included in the Public Engagement Appendix (Figure 6-5). Comment responses to letters and postcards were also highly detailed—and at times included lengthy emails to support understanding about more nuanced project details.



Question and Answers:

1. Besides actual floodwaters hitting my house, how much risk is there of it coming up through my sewer lines and into my basement?

During a large storm event, the ground gets saturated and has the potential to back up into the basement. The flood prevention handbook outlines those things that can be done. It can be found on the website. www.denvergov.org/DenverWaterways Please refer to the document on what you can do.

2. Are we anticipating higher floods? Is it going to be different?

Better information, including topographic data and survey information at obstructions (such as bridges and culverts) and more sophisticated modeling is being used to create the updated floodplain.

3. Will they replace what they've done before?

Urban Drainage and Flood Control District (UDFCD) and the City have done a lot of work over the last 10 years, some areas better than others. We want to update what is required to reduce the flood risks.

Figure 6-5. Organization of USACE response to public comments.

6.2.2.2 Examples of Public Concerns

One major concern reflected in public comments related to FRR was the perceived economic impacts, and most of the comments tagged as perceived economic costs were related to property value and potential property acquisition (Table 6-1).

A closer analysis of the public comments related to economic costs demonstrates concerns over property acquisition, the potential impacts of new floodplain mapping, and improvements either increasing property values and pushing residents out of the area, or the opposite (forced compliance with changes negatively impacting property values and therefore homeowners in the area). Being able to aggregate these comments in an organized and meaningful way could help streamline the process for development and revision of a study's appendices (in this case, the economic appendix). These types of concerns could either be addressed in a formal document or could involve a more comprehensive comment response in the public engagement appendix that addresses and educates the public on these perceived issues.



Table 6-1. Examples of segments extracted by USACE of comments coded as “Perceived Economic Costs” (USACE, 2019b).

Code	Segment
Perceived Economic Costs	I stand in firm opposition to Environmental Focused Alternative 2016. It is not necessary to take away homes from citizens where there are plenty of viable alternatives. Furthermore, this process is unfair and unjust and another solution must be found.
Perceived Economic Costs	Not everybody can wait for years for the city to acquire property. Earlier may be better. If you have to sell, because you’re older, you may be ready earlier.
Perceived Economic Costs	Budget? Rosedale Elementary? I'm terrified of skyrocketing property values. I have owned for 15+ years and plan on staying forever! A few improvements I appreciate, but don't make my neighborhood your project.

6.2.2.3 Public Concerns About Engagement

There were few comments expressing concern about engagement. Of those that were received, the common theme revolved around a general lack of communication. Two commenters indicated that they were not aware of the public meeting until the last minute, which—although this is a small number and may not be a significant issue for this particular case study—suggests that outreach could potentially benefit from other communication strategies that have not historically been utilized by USACE project teams. Because many residents may not check the *Federal Register* or even a desktop website, notifying the public of project-related meetings through other forms of social media could increase attendance of underrepresented groups and reduce this barrier to access. For this particular study, there were few public concerns about the quality of materials. Of the concerns that commenters did have, most were related to clarity of materials and missing data.

6.2.3 Discussion of Engagement Strategies

6.2.3.1 Engagement Practices Used by the USACE Project Team

USACE’s engagement efforts during project authorization were aligned with the agency guidance that existed at that time, and the USACE project team used the best available data to plan for and execute inclusive public meetings and workshops throughout the scoping and review phases.

6.2.3.2 Future Opportunities for Innovative Engagement Strategies

If this study were to be conducted under more recent guidance from EO 14008 (Executive Order No. 14008, 2021), there could be additional opportunities to directly engage with communities identified as disadvantaged. USACE project teams could use CEQ’s CEJST tool as a starting point for identifying where to target outreach and conduct meetings, and then track demographic representation in public engagement throughout the duration of a project to ensure proportional representation.



6.3. DISTRIBUTIONAL EQUITY ANALYSIS

6.3.1 EJ Analysis Conducted by USACE

Using required guidance at the time the study was conducted, the USACE project team summarized data related to population and housing (population, density per square mile, and number of housing units) and employment and income (median household income, unemployment rate, poverty rate, median home value, and industry details). To address EO 12898 (Executive Order No. 12898, 1994), the USACE project team identified some socially vulnerable communities in the delineated study area. The project team looked at data related to languages spoken at home, people in poverty, and people with disabilities.⁵ USACE also conducted a traffic analysis for Reach 6 of the Weir Gulch project due to the presence of an important bus route for potential EJ communities.

6.3.2 Geostatistical Environmental Equity Reanalysis

For the South Platte reanalysis, the study team calculated potential disproportionate impacts inside and outside the river access buffer boundary. Because this reanalysis measured recreational access through walking distance to river access points, those inside the walking buffer would be considered “positively impacted” and those outside the walking buffer residing throughout the rest of Denver County would be considered “negatively impacted.”

6.3.2.1 Impact Area Boundary Delineation

The first impact area boundary for the environmental equity reanalysis was determined by generating a 10-minute GIS walking buffer after plotting Denver’s South Platte River access points⁶, and then creating population-weighted centroids for each census block (for race and ethnicity) and for each census block group (for poverty status) that fell either partially or fully within the impact area boundary. Because of the nature of the decennial census and ACS datasets collected by the U.S. Census Bureau, the finest scale of data for race and ethnicity is at the block level, and the finest scale of data for income is at the block group level.

The populated-weighted centroids were used to determine whether a census block or block group would be included in the impact area. The use of these centroids ensures that, to the greatest extent possible, the locations of impacted populations are correctly identified. In the case of South Platte, census blocks and block groups for larger industrial areas along the river with concentrated populations outside the impact area were excluded to account for these edge effects and ensure that census blocks and block groups within the impact area were accurately represented.

⁵ Because of scope and time considerations, the distributional equity analyses included in this effort only included racial and ethnic groups as well as people in poverty identified by the 2020 U.S. Census. These analyses did not include people with disabilities. However, any adoption of the methodology outlined in this document should include this population, along with other underrepresented groups.

⁶ The South Platte River access points used to generate the walking buffer came from the Denver South Platte River Needs Assessment: <https://storymaps.arcgis.com/stories/13dd60449f79405e9a1acd4dd5109ea0>

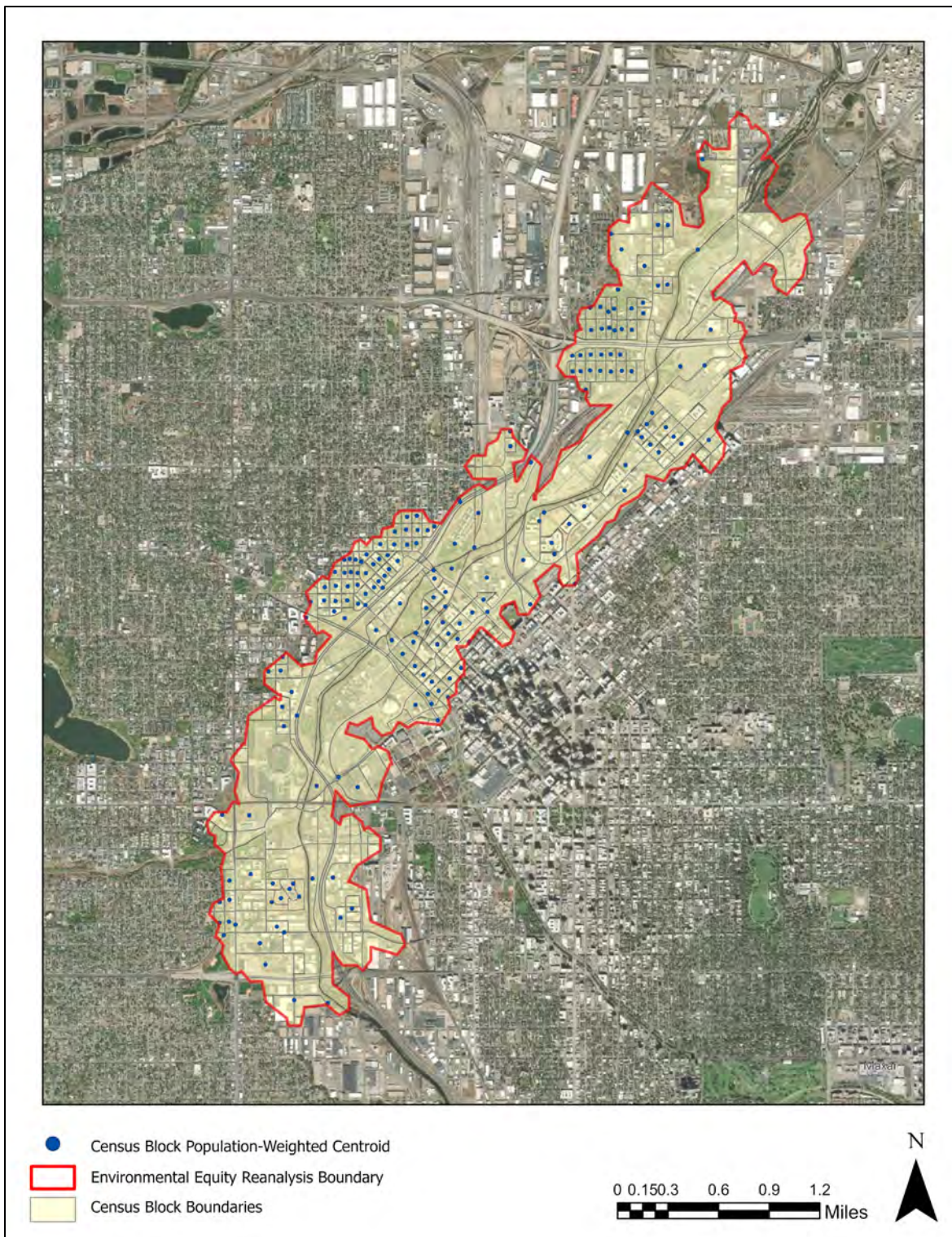


Figure 6-6. South Platte River Reach boundary used for geostatistical environmental equity reanalysis.

The second impact area that was part of this reanalysis was the Harvard Gulch-adapted hydrologic boundary. The study team used the same method of creating population density rasters to facilitate the creation and use of population-weighted centroids to account for edge effects.

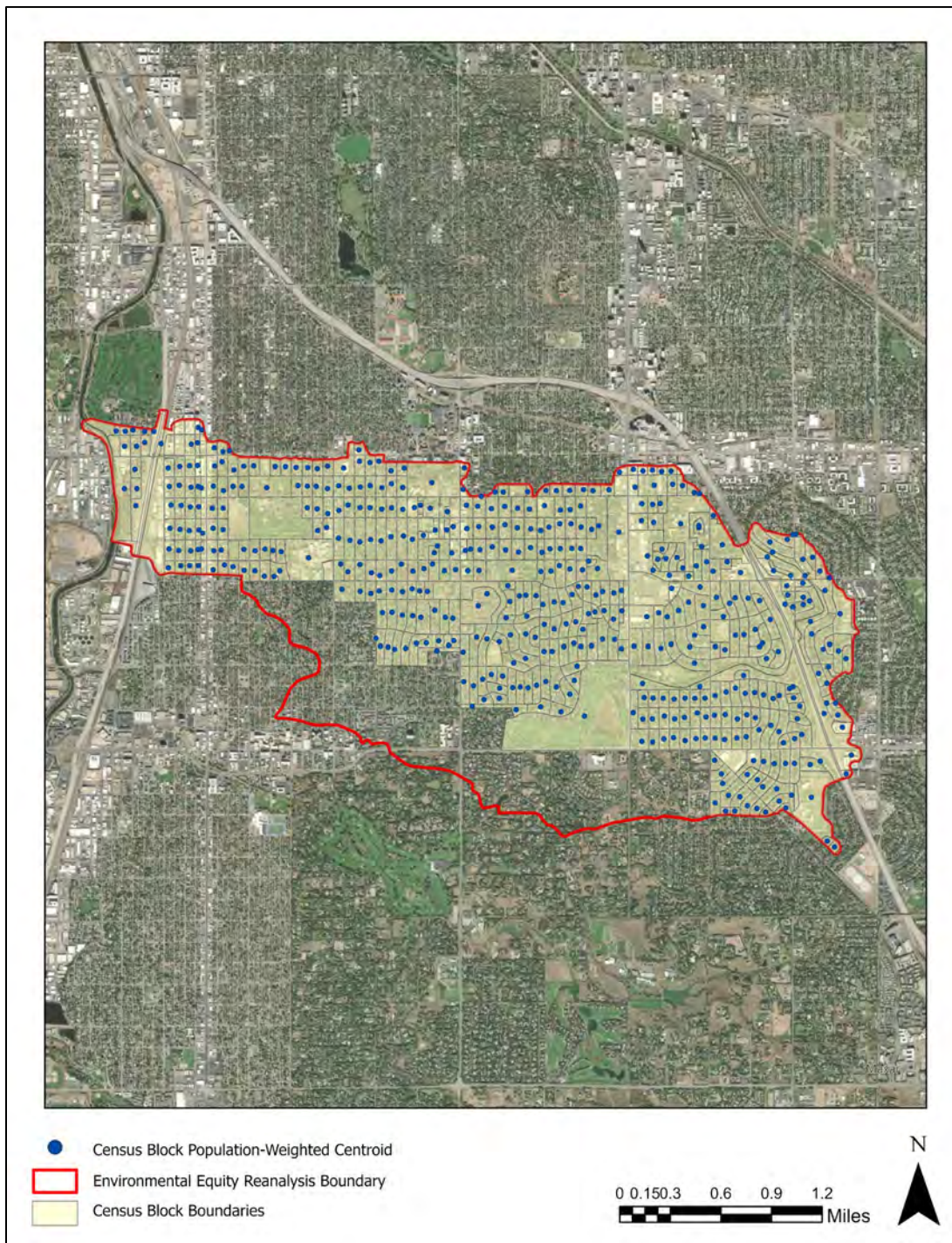


Figure 6-7. Harvard Gulch boundary used for geostatistical environmental equity analysis. Due to scope and time limitations, only data for Denver County was used for this reanalysis, which is why census blocks from Arapahoe County are excluded (Manson et al., 2023).

6.3.2.2 Results by Population Characteristics: Recreation Access Benefit Area

An odds ratio of one indicates that a specific racial or ethnic group is as likely to reside within a 10-minute walking distance of the project area as they are to reside beyond this distance. Figure 6-8



demonstrates that none of the racial or ethnic groups examined in this analysis are more likely to live within walking distance of the project than anywhere else in the reference area (the county). As a result, these groups are less likely to experience the potential recreational benefits generated by the project.

However, residents with income below the poverty line are approximately 1.5 times more likely to live within a 10-minute walking distance of the project area than they are to live beyond that distance. Results for residents living in deep poverty are similar, with an odds ratio of 1.34.

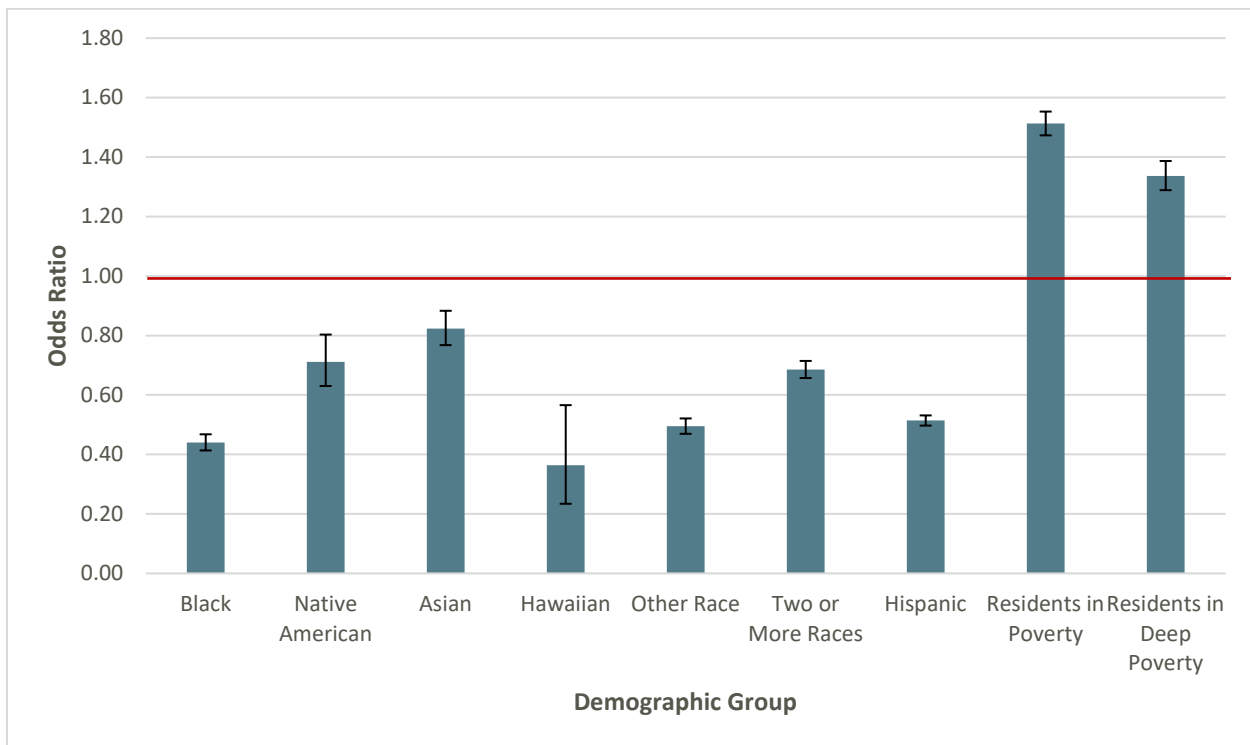


Figure 6-8. Odds ratios demonstrating the likelihood of demographic groups living inside the recreation access benefit area. The whiskers around each odds ratio in the figure represent 95% confidence intervals on the odds ratio. Only values for which the 95% confidence interval does not contain 1.0 are discussed in the text.

6.3.2.3 Results by Population Characteristics: Flood Risk Reduction Benefit Area

With the exception of the Asian population, no analyzed group is more likely to live within the FRR impact area than to live without it (Figure 6-8). Each of the other six racial and ethnic groups analyzed here are less likely to reside in the impact area and disproportionately experience any FRR benefits from the project.

The odds ratio for residents below the poverty line within the Harvard Gulch impact area is less than 1, meaning that this group is less likely to live in the FRR study area than they are anywhere else in the reference area. They would therefore be less likely to benefit from the FRR value of the project. Similar results were found for residents living in deep poverty. Having this kind of information can help USACE project teams better understand how specific demographic groups may or may not be positioned to benefit from proposed projects and can serve as an opportunity to use more specific data to inform boundary development.

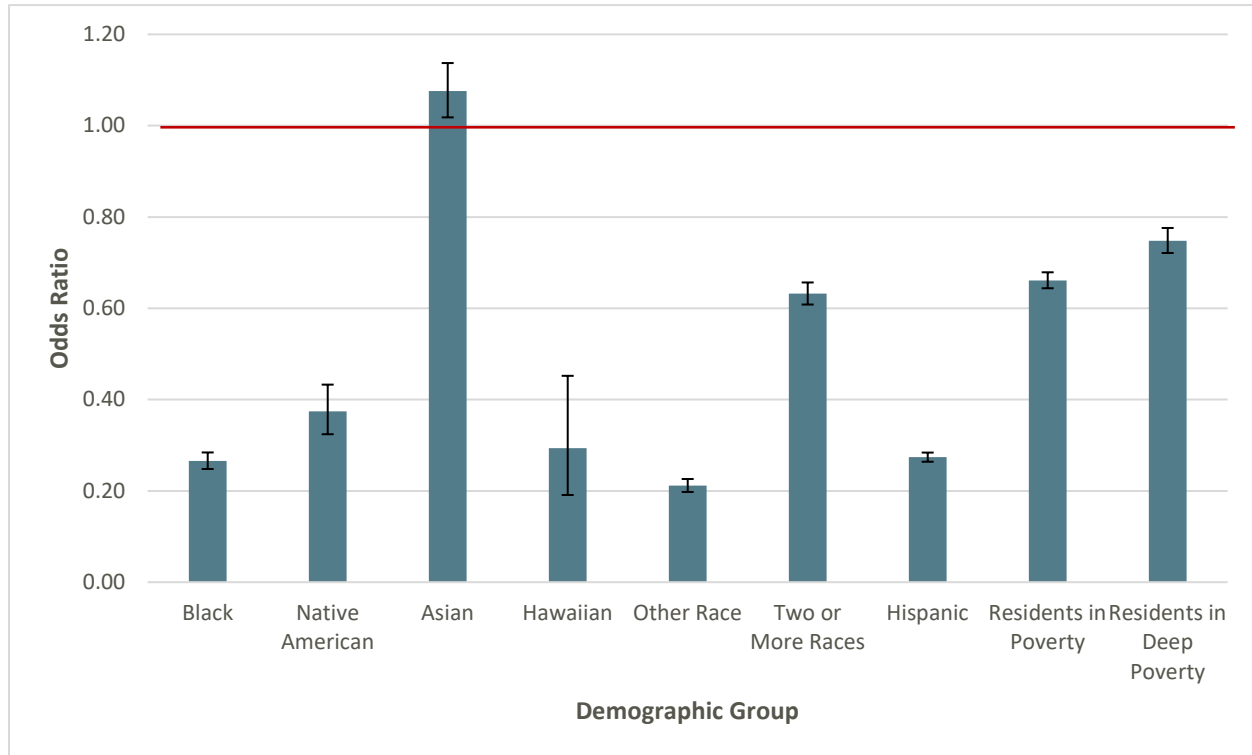


Figure 6-9. Odds ratios demonstrating the likelihood of demographic groups living inside the FRR benefit area. The whiskers around each odds ratio in the figure represent 95% confidence intervals on the odds ratio. Only values for which the 95% confidence interval does not contain 1.0 are discussed in the text.

6.4. ANALYSIS OF EQUITY WEIGHTING IN BCA

6.4.1 Preceding BCAs

6.4.1.1 Original Project BCA

The original USACE study calculated benefits for only the FRR portion of the project in Harvard and Weir Gulch (USACE, 2019a), while costs were calculated for both the FRR portion of the project and the ecosystem restoration portion across the river reaches.

6.4.1.2 2023 Reanalysis

The 2023 reanalysis took the original numbers for Plan #9 and augmented them with a calculation of the recreational benefits from the ecosystem restoration portion of the project using USACE's use day value (UDV) methodology (Fischbach, Dalyander, McHugh, et al., 2023). This approach assigns dollar values on the benefit of using various amenities within an area and sums them to find the overall value of a single day of usage which is then scaled by an estimate of the total number of used days. The following section focuses on applying the benefit weighting methodology to the UDV benefits from the reanalysis as well as the original Harvard Gulch benefits.

6.4.2 BCA Recalculation and Updated Benefits

The first step in the benefit weighting process is allocating the existing calculated benefits between the different census block groups in the study area. For the UDV benefits, the team opted for a



straightforward approach of apportioning the benefits relative to the total population of each walk group within the walkshed. This corresponds to an assumption that each person receives the same direct benefit (prior to modifying based on considerations of equity). Income weights were then calculated relative to three reference incomes. Weighted benefit increases relative to the unweighted value of \$1.8 million, regardless of the reference income used, reflecting the relative poverty of the census blocks in question. However, weighted benefit is highest for the state reference income (\$2.7 million), reflecting a higher statewide income compared to the Denver County median income. Both the state of Colorado and Denver County had higher median household incomes than the national average which resulted in the lowest weighted benefit (\$2.2 million) when used as reference.

Demonstrating how the weighting approach changes the spatial distribution of benefits across the river reaches, the first pane of Figure 6-10 shows the initial distribution of benefits allocated by the count of structures in each block group. The second pane shows the distribution of weights, calculated using block group income compared to county income as a reference point. The final pane shows the resulting weighted benefit from multiplying the initial benefits and weights.

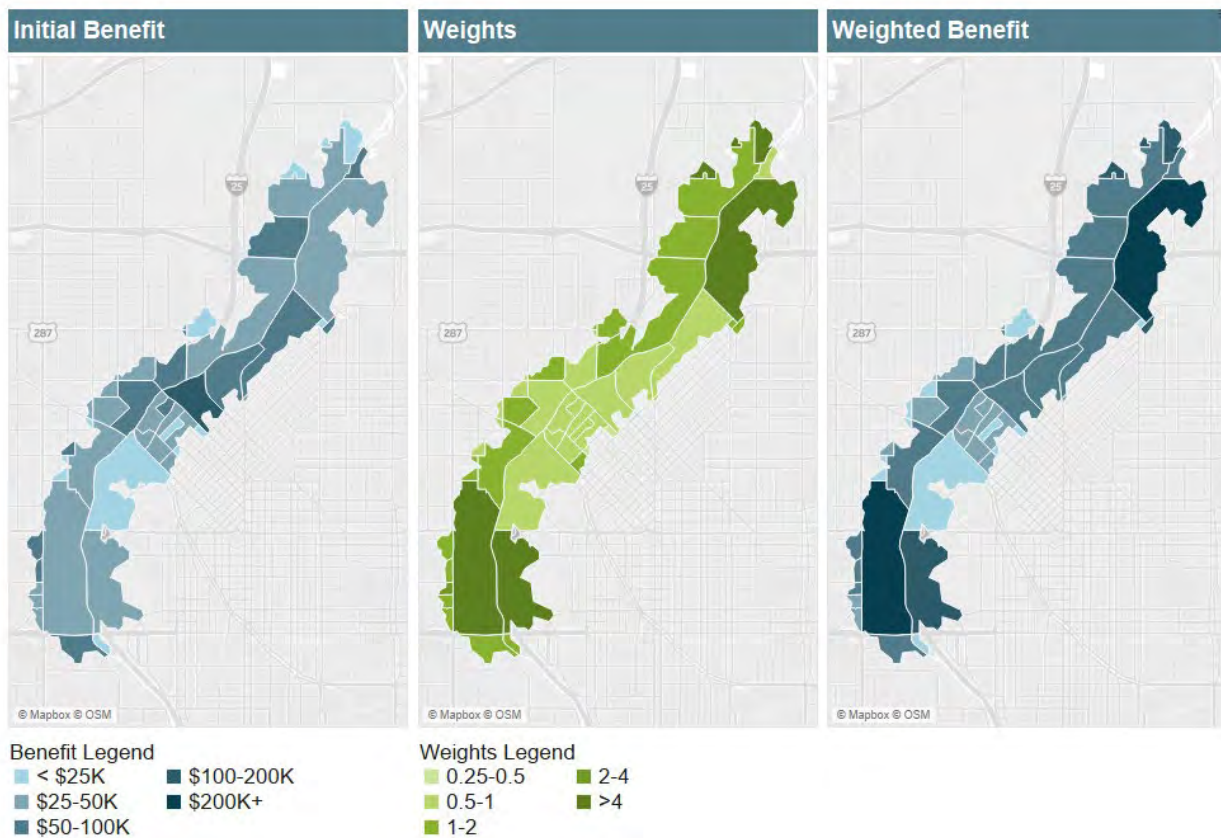


Figure 6-10. Spatial distribution of benefits and weights by block group.

While the initial benefits allocate most of the benefit to the central section of the project area, this region has lower weights relative to the northern and southern parts of the walkshed. The large block groups on the northern and southern edges of the project walkshed have some of the largest weights in the overall



project area, moving these block groups from the middle of the distribution of unweighted benefits to among the highest after the weighting.

The same process was performed on the FRR benefits for the Harvard Gulch project area. The first step of the analysis was again to divide benefits across block groups in the study area. The original USACE study did not provide a breakdown of benefits at this level of spatial resolution (USACE, 2019a), so the study team applied three different assumptions: an even distribution of benefits, a weighted approach by the count of structures in each block group, and a weighted approach that uses the estimated value of structures in each block group. Income weights were then calculated relative to three reference incomes.

A comparison across allocation methods and reference incomes is depicted in Figure 6-11. From the original benefit of 6.5 million the weighted benefits increased for the state and county reference incomes (\$6.6–7.1 million and \$6.8–7.3 million respectively, depending on allocation method) but generally fell for the US reference income (\$5.5–5.9 million depending on allocation method).

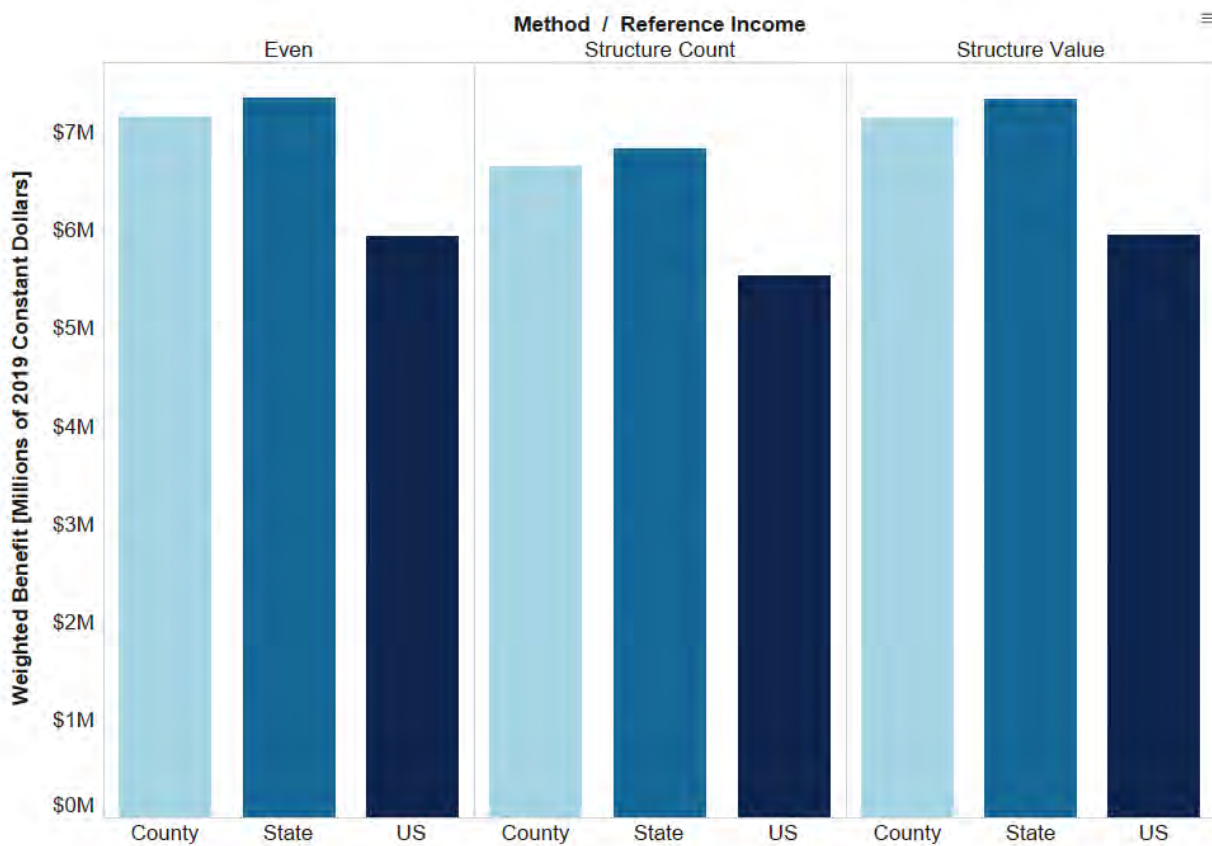


Figure 6-11. Weighted benefit by allocation method and reference income.

Demonstrating how the weighting approach changes the spatial distribution of benefits across the Harvard Gulch FRR benefit area, the first pane of Figure 6-12, reading from top to bottom, shows the initial distribution of benefits allocated by the count of structures in each block group. The second pane shows the distribution of weights, calculated using block group income compared to county income as a



reference point. The final pane shows the resulting weighted benefit from multiplying the initial benefits and weights.

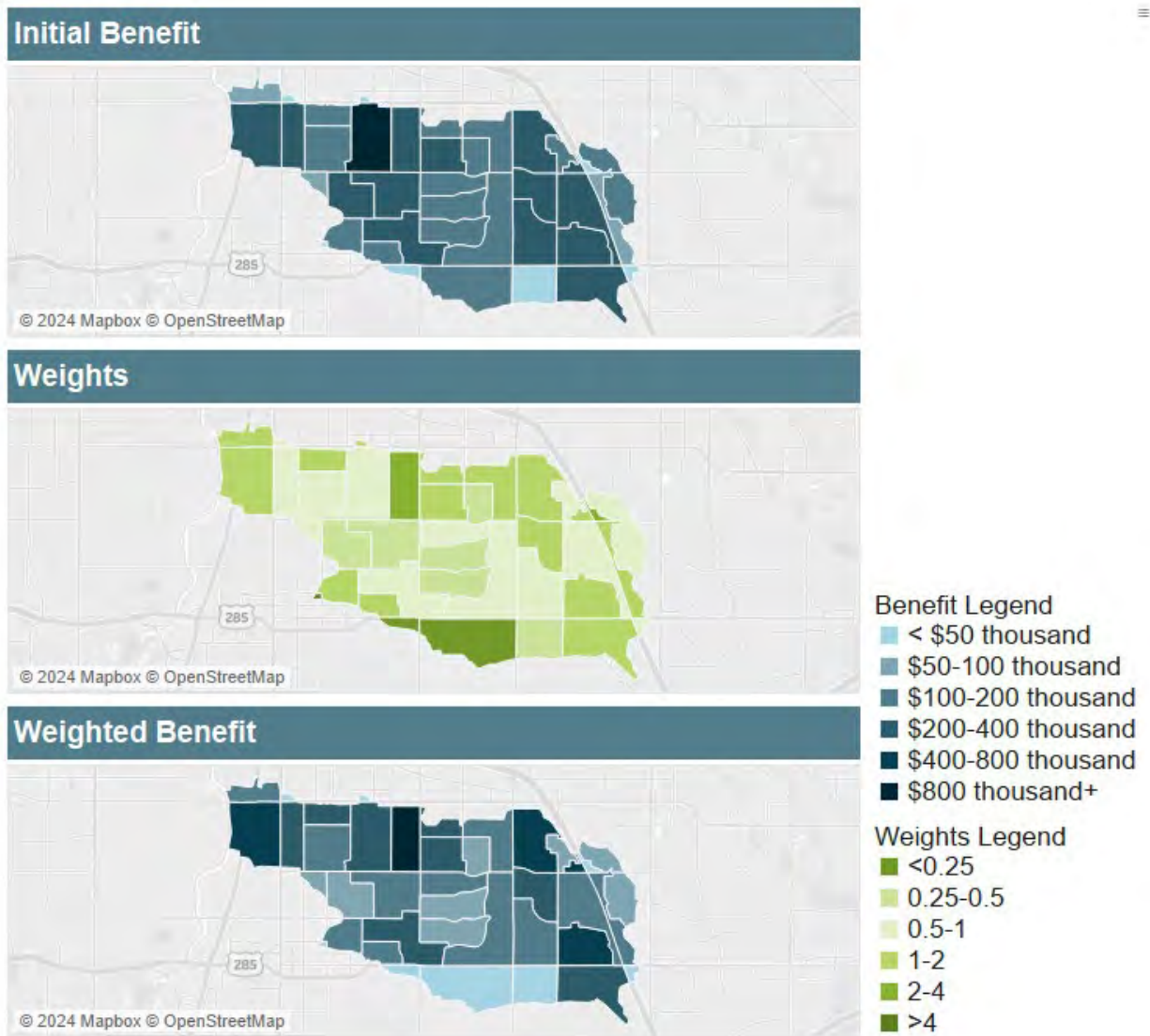


Figure 6-12. Spatial distribution of benefits and weights by block group.

Few blocks have weights greater than two assigned to them, but several have weights below one, resulting in lower weighted benefits in the central and southern parts of the project area. The northern edge of the project area had both relatively high weights and relatively high allocated benefits resulting in generally higher weighted benefits across these block groups as compared to the rest of the project area.

In general, the choice of allocation approach and reference income can also make a substantial difference in the spatial distribution of benefits. Figure A-20 shows weighted benefit mapped by block group for all nine combinations of allocation approach and reference income considered in this analysis. Weights rise slightly for all block groups as reference incomes increase from the county to the state level. By contrast weights are much lower across block groups when the reference income is set to the US level. Due to the



method of calculation the effect is not uniform across different block groups: block groups with the most extreme weights (high or low) are most affected by the choice of reference income. The effect of the benefit allocation is more spatially variable. For example, the maps reveal the relative consistency of the benefits across weighting methods as evidenced by consistently high weighted benefit in the northwestern part of the study area and consistently low weighted benefits in the southern part of the study region.

6.4.3 Weighted BCA Recalculation

The study reanalysis combined costs and benefits into two BCR values, one based on the project year water resources discount rate of 2.875% and one based on the OMB discount rate of 7%. The costs and benefits expressed as AAEQs and the BCR for these two discount rates for Plan #9 can be found in Table 6-2. Though the reanalysis included several additional sources of costs and benefits, these were excluded from the current calculation. In addition, Table 6-2 contains cost, unweighted benefit and BCR recalculated using a 2% discount rate. The effect of lowering the discount rate is to lower the AAEQ cost and thus raise the overall project BCR as compared to the values used in the original USACE analysis.

The same set of calculations was then performed using the weighted benefits. These values can be found in Table 6-3.

Table 6-2. BCA values for the original study benefits for three different discount rates. All values in millions of dollars.

	Water Resources (2.875%)	OMB 1992 (7%)	OMB 2024 (2%)
Benefit (AAEQ)	\$8.4	\$8.4	\$8.4
Benefit (NPV)	\$222	\$116	\$264
Cost (AAEQ)	\$15.0	\$31.6	\$12.3
Cost (NPV)	\$395	\$437	\$386
BCR	0.56	0.27	0.68

Table 6-3. BCA values for the weighted benefits for three different discount rates. All values in millions of dollars.

	Water Resources (2.875%)	OMB 1992 (7%)	OMB 2024 (2%)
Benefit (AAEQ)	\$9.5 (\$7.7–\$10.0)	\$9.5 (\$7.7–\$10.0)	\$9.5 (\$7.7–\$10.0)
Benefit (NPV)	\$251 (\$204–\$265)	\$132 (\$106–\$139)	\$299 (\$243–\$315)
Cost (AAEQ)	\$15.0	\$31.6	\$12.3
Cost (NPV)	\$395	\$437	\$386
BCR	0.63 (0.51–0.67)	0.30 (0.24–0.31)	0.77 (0.62–0.81)

6.4.4 Discussion

Under the study team’s original reanalysis the South Platte project was not able to reach a BCR of 1 under any of the assumptions that the team considered (USACE, 2019a). This is true even when factoring in the equity weighted benefits. Overall, the additional benefits included from UDV calculations are not enough to compensate for the added cost, especially given the relatively modest FRR benefits from the Harvard Gulch section of the project.



7.0 SOUTHWEST COASTAL LOUISIANA

7.1. INTRODUCTION

7.1.1 Study Area

The Southwest Coastal Louisiana study area (Figure 7-1) covers 4,700 square miles and comprises the entirety of Calcasieu, Cameron, and Vermilion parishes (counties).⁷ The southern portion of the study area consists of a system of estuarine lakes and coastal marshes interspersed with chenier ridges, which are slightly more elevated ground than their surrounding landscape. These ridges are where most development along the coast has occurred (Fischbach, Dalyander, McHugh, et al., 2023). The landscape in the northern portion of the study area transitions to coastal prairie and contains the Lake Charles Metropolitan Area, where approximately 75 % of the study area's approximately 280,000 (as of 2020) people reside. Despite its sparse population, southwest coastal Louisiana's oil and gas, navigation, and commercial and recreational fishing industries are important contributors to the regional and national economies.

The study area has been negatively impacted by a series of tropical storms and flood events since 2005, including hurricanes Laura and Delta in 2020. However, the Southwest Coastal Louisiana study was commissioned to investigate FRR and environmental restoration features, as well as address the impacts of hurricanes that occurred in the area prior to 2016 when the study was completed (USACE, 2016a).

7.1.2 Demographics

For the Southwest Coastal Louisiana case study, the study team used the USACE study area to calculate potential ecosystem restoration benefits. In the ecosystem restoration benefit area, the three largest racial groups include people identifying as White (66.6%), Black (22.4%), and Two Races (3.4%). Five percent of residents in the recreation access benefit area identify as Hispanic (Table A-6). A higher percentage of residents identifying as Hawaiian live inside the ecosystem restoration benefit area than outside in the reference area.

7.1.3 Final Alternative

The final report included NER and NED RPs consisting of ecosystem restoration and risk reduction measures, respectively. The NER RP (Figure 7-2) included marsh creation, chenier reforestation, and shoreline protection features to address land loss and ecosystem degradation. The NED RP (Figure 7-3) proposed nonstructural measures such as residential elevation, dry floodproofing of non-residential structures, localized storm risk reduction measures for industrial facilities and warehouses, and voluntary acquisition/relocation assistance intended to mitigate flood damage.

⁷ See Fischbach et al. (2023), chapter 4, for more background information on this case study.

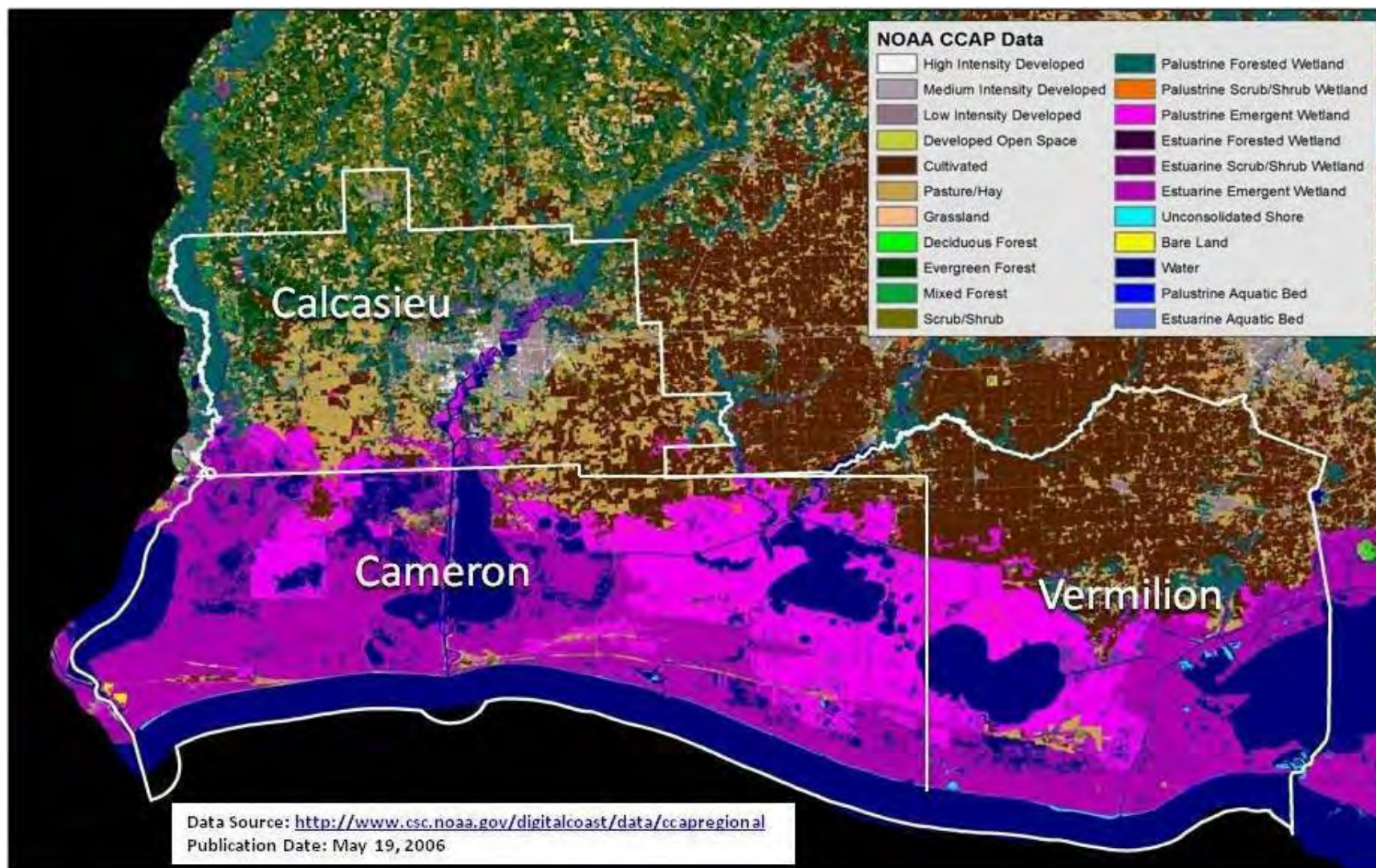


Figure 7-1. Study area: Southwest Coastal Louisiana (USACE, 2016a)

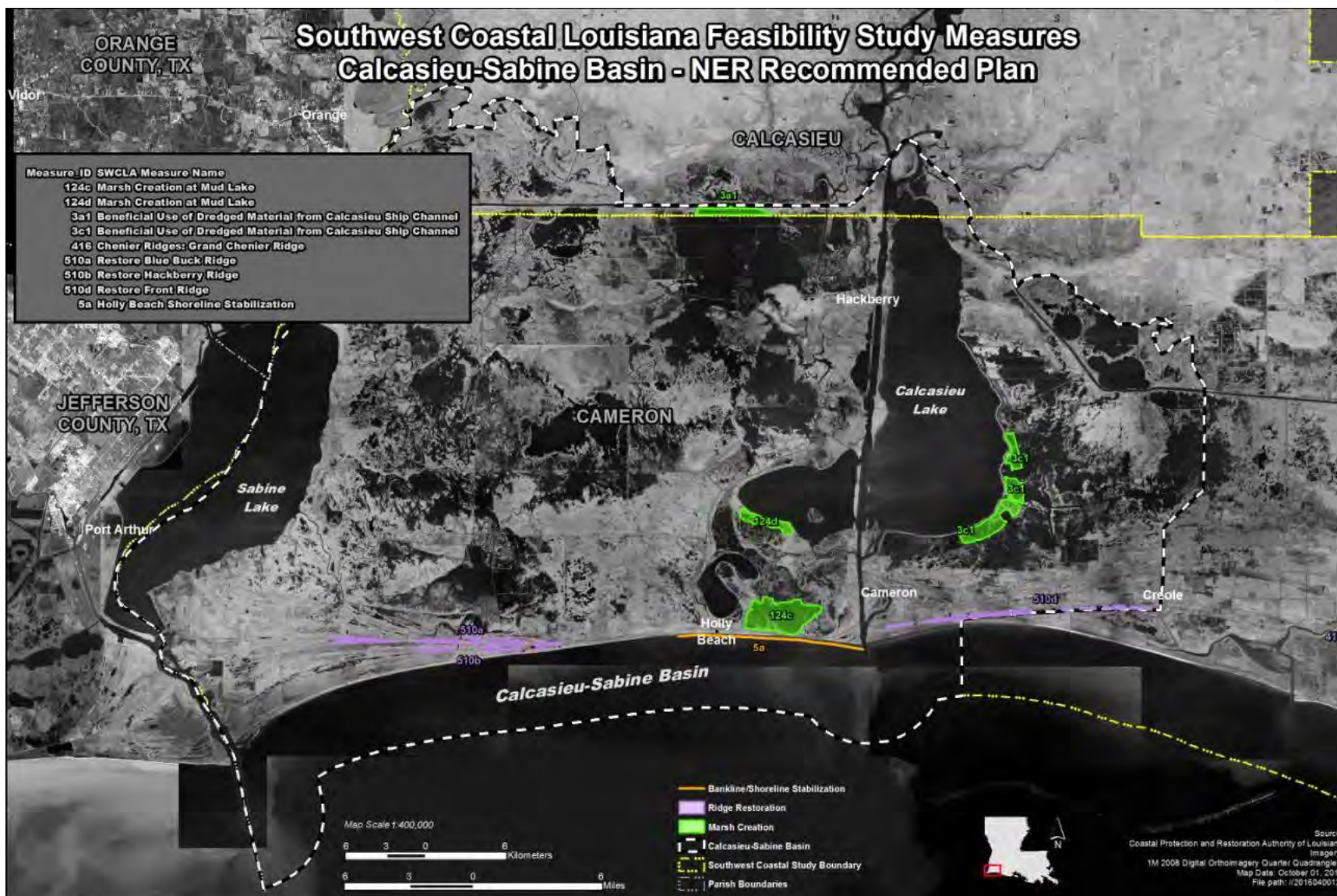


Figure 7-2. Southwest Coastal Louisiana final NER recommended plan (USACE, 2016a).

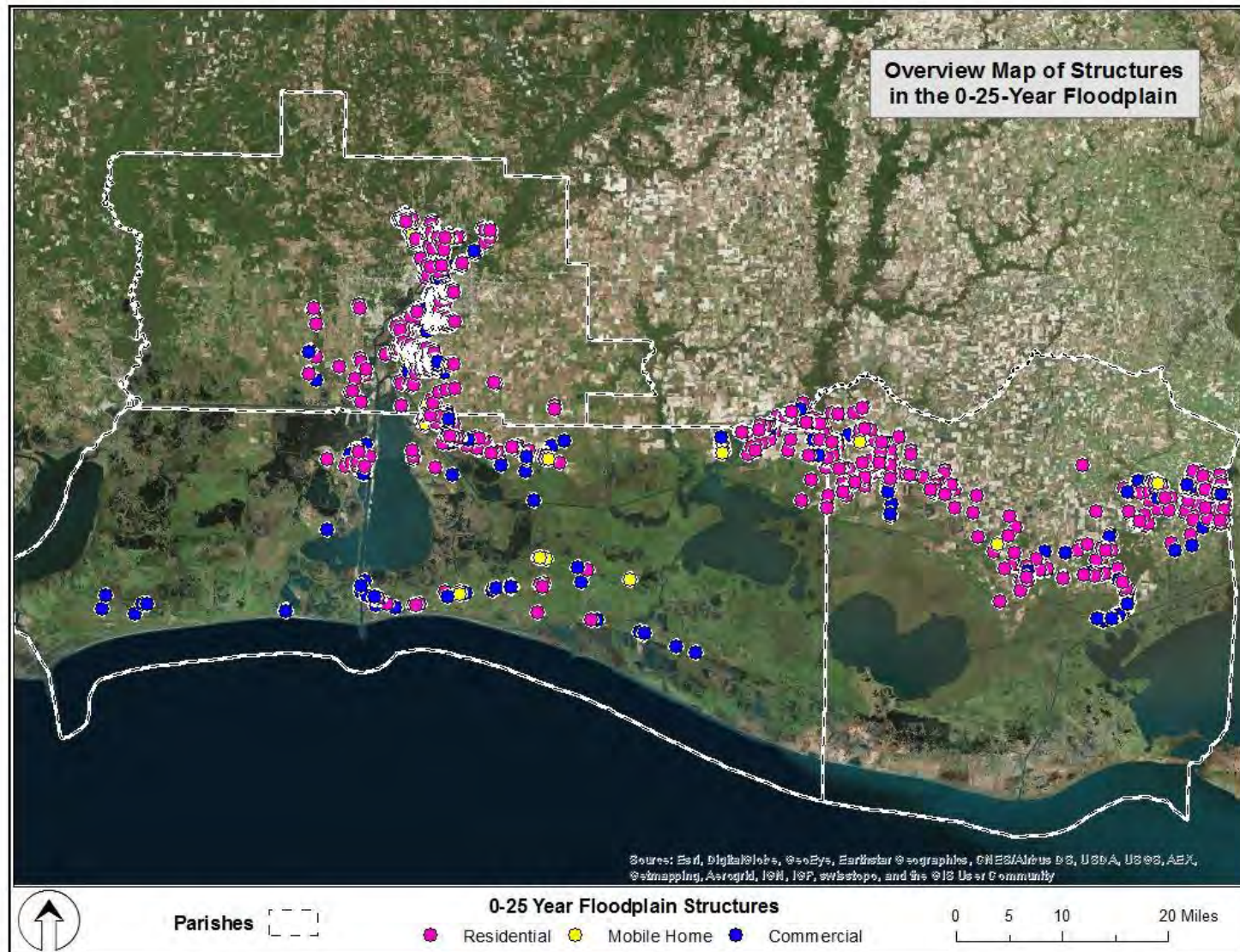


Figure 7-3. Eligible structures included in the final NED Recommended Plan's nonstructural program (USACE, 2016a).



7.2. PROCEDURAL EQUITY ANALYSIS

7.2.1 Analysis of Stakeholder Engagement

7.2.1.1 Scoping Process

Although the study was authorized in December 2005, the official scoping process did not begin until 2009 when USACE launched its 45-day scoping period through publication of its NOI to prepare a draft EIS in the *Federal Register* on February 27, 2009 (USACE, 2016a). USACE also provided its public scoping meeting announcement to over 200 media outlets; five local newspapers in New Orleans, Baton Rouge, Cameron Parish, Calcasieu Parish, and Vermilion Parish advertised the public meetings. Additionally, USACE mailed scoping meeting announcements to federal, state, and local agencies to request their comments regarding the scope of the study.

The USACE project team held three public scoping meetings (one in each of the three parishes included in the study area) on weekday evenings in March 2009. These meetings were attended by 280 people overall (51 in Cameron Parish, 59 in Calcasieu Parish, and 170 in Vermilion Parish). Although comments received during the scoping phase are not provided in the study documentation, the scoping report (USACE, 2009) indicates that 382 comments were received via scoping meetings, comment cards, letters, emails, and evaluation forms. The Scoping Report states that predominant themes among comments received were related to storm risk reduction, the importance of considering the entire scope of study and cumulative effects of other projects, and coastal protection.

Table 7-1. Engagement efforts by study phase.

Engagement Efforts	Study Phase		
	Scoping (2009)	Initial Draft (2013)	Final Draft (2015)
Number of public meetings	3	2	3
Meeting participants (total)	280	121	184
Comments received	382	578	2,752

The project team also held various stakeholder meetings and presentations between 2009 and 2013, noting that meeting participants were most interested in potential levee alignments and community impacts (USACE, 2013). The initial draft report was released in December 2013 and made available for public review and comment for 45 days. Public comments received regarding the 2013 initial draft report are not included in study documentation, but *Appendix J: Comments and responses to the Revised Integrated Draft Feasibility Report and Environmental Impact Statement* (USACE, 2016b) states that they are available upon request. The study team did not request or analyze the 2013 public comments.

US EPA published the *Revised Integrated Draft Feasibility Report and Environmental Impact Statement* in the *Federal Register* (USEPA, 2013), with USACE subsequently filing notice of availability of the draft, on March 20, 2015. USACE posted the report to the study webpage and distributed it to federal, state, and local agencies, federally recognized Tribes, and other interested and affected parties for review and comment by May 4, 2015 (a 45-day comment period). USACE also distributed news releases to local media outlets announcing public hearings, placed paid advertisements in local newspapers in the study area, and notified NGOs involved in local coastal restoration. Additionally, meeting information was



posted on the USACE New Orleans District website, as well as on their social media accounts (i.e., Facebook and X, formerly known as Twitter).

Three public hearings were conducted (one in each parish) on weekday evenings in mid-April 2015 with over 184 people in attendance (61 in Vermilion Parish, 21 in Calcasieu Parish, and 102 in Cameron Parish). These public meetings were attended by residents and representatives from local government agencies alike and many people offered comments on the draft. The USACE New Orleans District received a total of 2,752 comments, including: 2,540 signatures on petitions; 50 emails; 40 oral comments during the public hearings; 34 governmental (including federal, state, parish, and local); 10 letters; 7 postcards; and 4 telephone comments received during the comment period. (USACE, 2016b)

Although some of the comments were made by the same person or agency across multiple formats (e.g., at a public meeting, through a signed petition, and/or via email), public participation in the comment periods for the Southwest Coastal Louisiana feasibility study was higher than all other case studies included in this report.

7.2.2 Review of Public Comments

7.2.2.1 Stakeholder Comment Trends

USACE's collection of and response to comments on the 2015 draft report were well-organized and addressed the root of each question or concern (USACE, 2016b). Comments were grouped into a table by mode of comment (e.g., email, government comments, etc.) and include the source (i.e., stakeholder type), the comment made, and USACE's response (Figure 7-4).



Table 3. Comments on the Revised Integrated Draft Feasibility Report and Environmental Impact Statement							
Comment #	Person/Agency	Date	Source of Comment	Mode of Comment	Theme	Comment (may be paraphrased or summarized)	Response
EMAIL COMMENTS							
30	City of Lake Charles Mayor Randy Roach	April 29, 2015	City of Lake Charles	email/letter	National Flood Insurance Program / eminent domain	1. We request that in the event the National Flood Insurance Program (NFIP) remains a relative part of the Study, that all eminent domain references be removed and that all owners of property identified as being candidates for relocation be notified and allowed opportunity to review the Study and make public comment.	The Recommended NED Plan would be entirely voluntary participation. *See response to "involuntary participation" and "eminent domain" comments in General Responses located at the end of this table. The requirements under the authorized National Flood Insurance Program were considered during the study. The Final Integrated Report will be available for public review during State and Agency Review.
31					Congressional authorization of use of flooding for coastal restoration	2. We further recommend that if "flooding" is to be used as a part of the criteria to develop and implement coastal restoration projects in this or any other coastal region of the country, such rule be based on a new set of standards authorized by Congress and which address: a) the unique hydrological characteristics of any coastal region affected by such regulations; b) the need to protect the history, culture and related socioeconomic characteristics of such coastal regions; and c) be designed to protect coastal residents from forced relocation of residences and businesses from those areas.	The recommended plan has been developed within Congressional authorizations specific to hurricane storm surge risk reduction as well as ecosystem restoration.
32					Cameron and Vermilion Parishes priority projects	3. We recommend adding an appendix to the report to include a list of all priority projects submitted by Cameron and Vermilion Parishes in order to make sure that these projects will be eligible for consideration in any future funding opportunities.	Parish priority projects have been included in Appendix N to the report.

Figure 7-4. Organization of USACE response to public comments on 2015 draft report (USACE, 2016b).



The majority of stakeholder comments (77%) received about the 2015 report draft came from either the general public or local government agencies (Figure 7-5). State and federal agencies comprised 20% of comments. Of the stakeholders who offered their occupational affiliation during the public comment period, roughly 1% each were from private businesses or non-profit organizations. One representative from a local utility agency contributed comments and no comments were received from representatives of Tribal governments, regional governments, or academia.

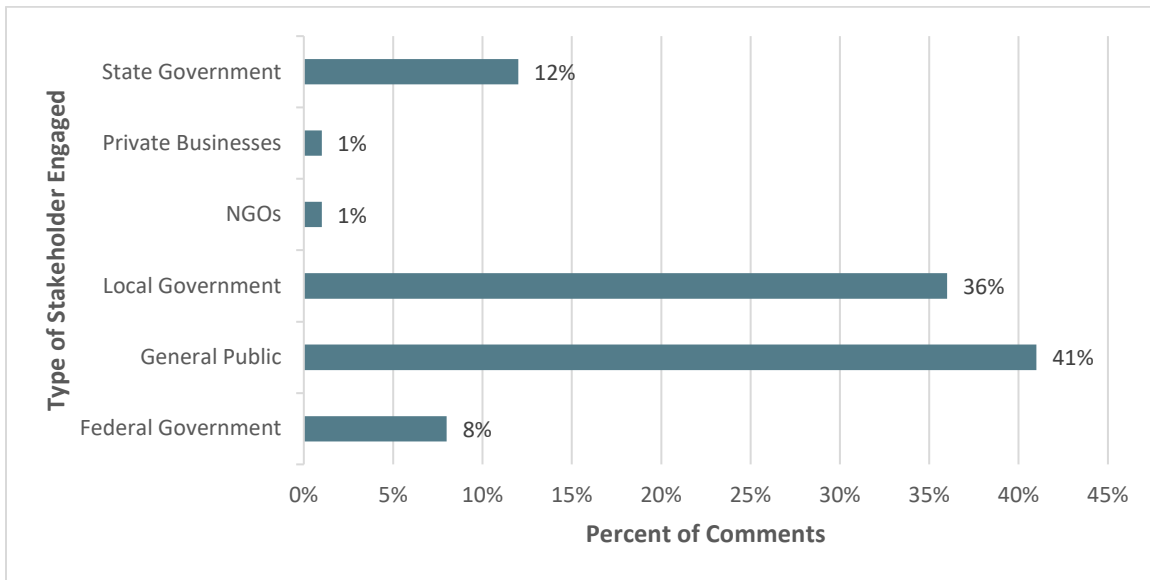


Figure 7-5. Types of stakeholder comments.

USACE received the greatest proportion of comments on the 2015 draft report through correspondence with government agencies (38%). However, comments made via email and public meetings totaled nearly half (48%) of all comments when combined. Stakeholders submitting comments via petitions and letters/postcards represented a combined total of 14%, with telephone comments (1%) being the least used method of submitting comments.

7.2.2.2 Examples of Public Concerns

Considering the multiple cascading disasters that impacted the study area between 2005 and 2008, many residents were still in the process of recovering from a series of hurricanes while USACE conducted this study. Therefore, public comments reflected more concern over building structural flood protection (and its benefits to the community) than how much it would cost to implement. Many residents also indicated that if measures were not taken to protect southwest Louisiana, their culture and way of life would be in jeopardy.

Ecological benefits (40%) and flood protection (28%) garnered the highest number of comments tagged as perceived benefits. However, these perceived benefits also ranked highest for perceived costs, with



flood protection perceived as the highest cost at 38%, followed by ecological costs at 26%.⁸ Although representing smaller proportions individually, cultural and economic costs and benefits accounted for roughly a third of all tagged comments in the perceived costs and perceived benefits categories when combined (Table 7-2).

Table 7-2. Examples of segments extracted by USACE of comments coded as “Perceived Flood Protection Costs”. (USACE, 2016b).

Segment
Due to the inability to meet your current 'cost/benefit ratio' standards, only a very small list of measures have been 'tentatively selected'. While the selected list may indeed be cost effective, I feel that our parish deserves 'protection'. In order to clearly support any future consideration of funding for a structural protection measure, I ask that you insert a LIST of ALL of the measures and projects proposed in the parishes' existing and proposed Coastal Restoration & Protection Plans. The inclusion will eliminate all unintentional exclusion of projects that were not tentatively selected and will clearly indicate worthiness for future consideration for funding. Inclusion of these projects will also allow the study to reflect the original purpose and intent of Rep. Boustany's bill, which was always to provide hurricane protection to Southwest Coastal Louisiana. The resiliency and efficiency shown by the parish's residents and business owners in protecting their homes and buildings should not have lessened the urgency and consideration given to protecting the land on which those structures have been built. I ask that any and all reference or language to 'eminent domain ' and 'involuntary participation' be completely removed from this study. The property owner's choice remains at their 'own risk' or possibly without future assistance are the only appropriate alternatives to 'voluntary participation'. I do not agree that protecting the Federal government's interests should supersede the choices that landowners make.
I ask that reforestation measures be replaced with shoreline protection measures. Reforestation is the most cost-effective measure proposed in the study. By deleting all protective levees and structures out of the 'Temporary Selected Plan', the Corp's was able to meet one of its highest priorities, cost effectiveness. More shoreline protection is critical. Previous projects have shown that reforestation will be successful only after protection is implemented. Shoreline protection would be a better investment for our coast's future.
We see where we have projects and the reforestation is great. It's going to be a barrier. It's going to stop -- it's going to stop a surge but what killed it in the first place? And I know that that's not where y'all are at now, but we should know what kills it before we have it in a plan to put it in. I know that it's a cheaper alternative than having a hard structure somewhere but in our parish's view, one of the most important things that was in the study from when they first started, which was shoreline protection from Fresh water Bayou to Southwest Pass that was taken out.

7.2.2.3 Public Concerns About Engagement

Another element observed regularly in public comments related to flood protection costs and benefits regarded the use of “involuntary participation” and “eminent domain” language included in the 2015 draft report (USACE, 2013). Although there were general concerns about engagement, as well as more specific

⁸ Comments about flood protection and ecological costs generally veered towards the public’s perception that structural and/or shoreline protection would be necessary to reduce future flood risk and prevent continued erosion and land loss along the coast (Table 11). Many people requested that USACE consider incorporating projects from parishes' existing and proposed coastal restoration and protection plans into the final plan. Other commenters pointed out that 1) the cost to elevate a residential structure is expensive and 2) although it may protect homes from storm surge, it also increases the risk of wind damage from a tropical storm.



comments related to lack of communication, unclear processes, and the review timeline, 91 comments tagged as public engagement concerns were related to equity issues raised (Figure 7-6).

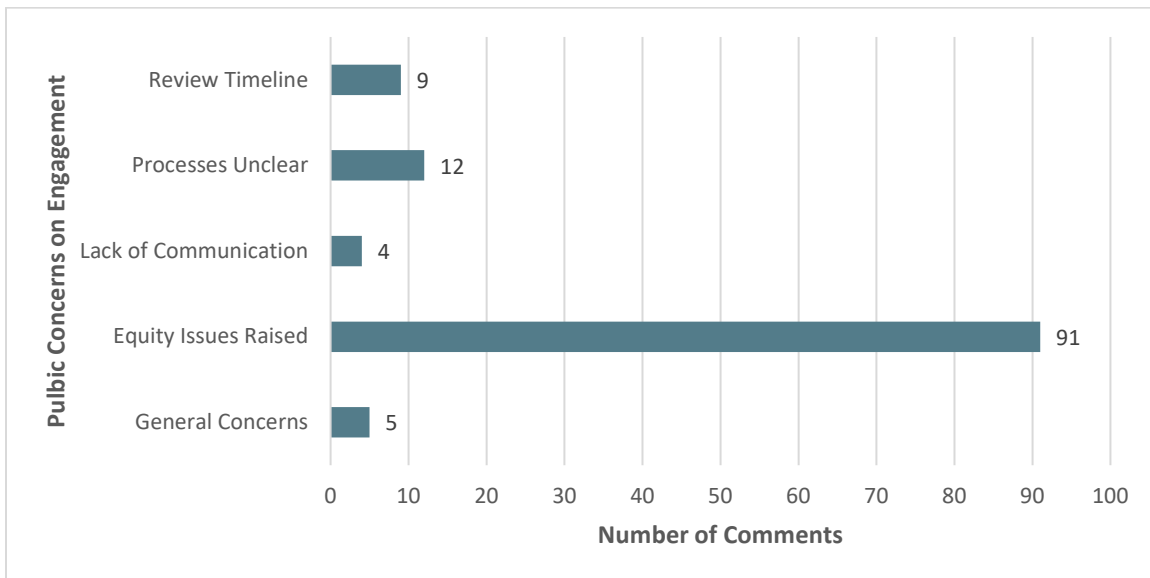


Figure 7-6. Public concerns on engagement.

Although the 2015 draft report included both voluntary and involuntary buyout measures, nearly all public comments related to equity concerns were in relation to the latter and derived from the use of “involuntary” language when referring to participation in property buyouts. Most of these public comments related to perceived unfairness surrounding the involuntary nature of the buyout measures proposed. One resident stated that the NED plan discriminates against property owners in coastal Louisiana. The resident expressed that people who live in other parts of the US are not being told by the Corps or other Federal agencies to disaster-proof their homes or face eminent-domain seizure of their property. They suggested that by not treating all disaster-area residents the same, the Corps is discriminating against the residents of coastal Louisiana (USACE, 2016b).

Other residents expressed concern over the logistical issues surrounding buyouts, as well as the challenge in making financial decisions with so much uncertainty surrounding future property ownership. For example, one resident indicated concern over whether to continue investing in property improvements if their property were to be scheduled for inclusion in involuntary buyout measures. This resident submitted a comment via email, stating,

This Study is saying that you can take our land from us and there are 400 structures that are in the Involuntary Participation. I have spent almost \$40,000 on improving our land. How can I find out where we stand within this study? I do not want to wait a year and waste more money if you are going to come to me and say get out. (USACE, 2016b)

USACE resolved these issues in the final plan by replacing all references to “involuntary participation” and “eminent domain” with 100% voluntary buyout options (USACE, 2016a).



7.2.3 Discussion of Engagement Strategies

7.2.3.1 Engagement Practices Used by the USACE Project Team

Despite the relatively sparse population and rural nature of the study area overall, Southwest Coastal Louisiana received the greatest number of public comments among the six case studies included in this report. The USACE project team held multiple public meetings in each of the three parishes included in the study area, which allowed for a variety of stakeholder input. The project team also placed advertisements providing meeting details with several local news media outlets, which may have contributed to high turnout at the public meetings.

Additionally, although the initial draft report comments from 2013 were not included in the study documentation (and were only available upon request, as previously mentioned), subsequent comments received and responded to during the 2015 public comment period indicate that USACE incorporated public input into the final plan. After receiving strong opposition from the public, USACE removed “involuntary” from all language surrounding property acquisition in the final report and instead proposed that participation in buyouts be completely voluntary.

7.2.3.2 Future Opportunities for Innovative Engagement Strategies

Although public engagement between the release of the 2013 initial draft and the 2015 revised draft is not a requirement of the NEPA process, an additional round of public engagement may have been beneficial to the development of the Southwest Coastal Louisiana feasibility study. Involving potentially impacted residents in the planning process before releasing a final draft report might have helped USACE avoid any animosity experienced during the public comment period over the issue of adding involuntary participation in buyouts to the 2015 revised draft. Public comments on the 2015 draft indicated that the addition of involuntary buyout measures after the December 2013 draft was made “unbeknownst to these parishes” and “considered in the eleventh hour” (USACE, 2016b). Despite the USACE project team’s otherwise robust engagement efforts throughout the study, public comments on the 2015 draft were significantly higher than those received during the 2013 comment period (over 2,100 more comments in 2015 than were provided in 2013). Although it is impossible to attribute this increase exclusively to the addition of “involuntary participation” to the proposed buyout measures, it raises the question of whether the response would have been as robust if this language had not been included in the 2015 draft report.

Therefore, future opportunities for engaging the public could include outreach between the release of multiple drafts, or perhaps during the alternative formulation phase. This additional outreach effort might reduce public concerns expressed during subsequent comment periods and serve to educate the public and promote understanding of why certain measures are eliminated. This interim engagement might also lead to greater support for the final plan and ensure that its benefits are aligned with EO 14008 requirements.

7.3. DISTRIBUTIONAL EQUITY ANALYSIS

7.3.1 EJ Analysis Conducted by USACE

Following the environmental justice requirements that existed at the time the study was conducted, the USACE project team for the Southwest Coastal feasibility study conducted an EJ analysis by identifying EJ communities (communities defined by minority composition and percent of population existing at or below the federal poverty level), and focused on the potential for disproportionately high and adverse



impacts during the construction phase and the proposed nonstructural risk-reduction measures. Ultimately, the project team identified that there were not expected to be any disproportionate EJ impacts from either the NED or NER RPs under EO 12898 (USACE, 2016a).

7.3.2 Geostatistical Environmental Equity Reanalysis

For the Southwest Coastal Louisiana reanalysis (USACE, 2016a), the study team calculated potential benefits inside the three-Parish study area boundary originally delineated by USACE for the feasibility study. Because this reanalysis involved measuring ecosystem restoration benefits, those inside the boundary would be considered “positively impacted.”

7.3.2.1 Impact Area Boundary Delineation

Impact area boundaries for the environmental equity reanalysis were determined by first applying the USACE-delineated study area boundary for the project, and then creating population-weighted centroids for each census block (for race and ethnicity) and for each census block group (for poverty status) that fell either partially or fully within the study area (Figure 7-7). These centroids were then used to determine whether a census block or block group would be included in the impact area.

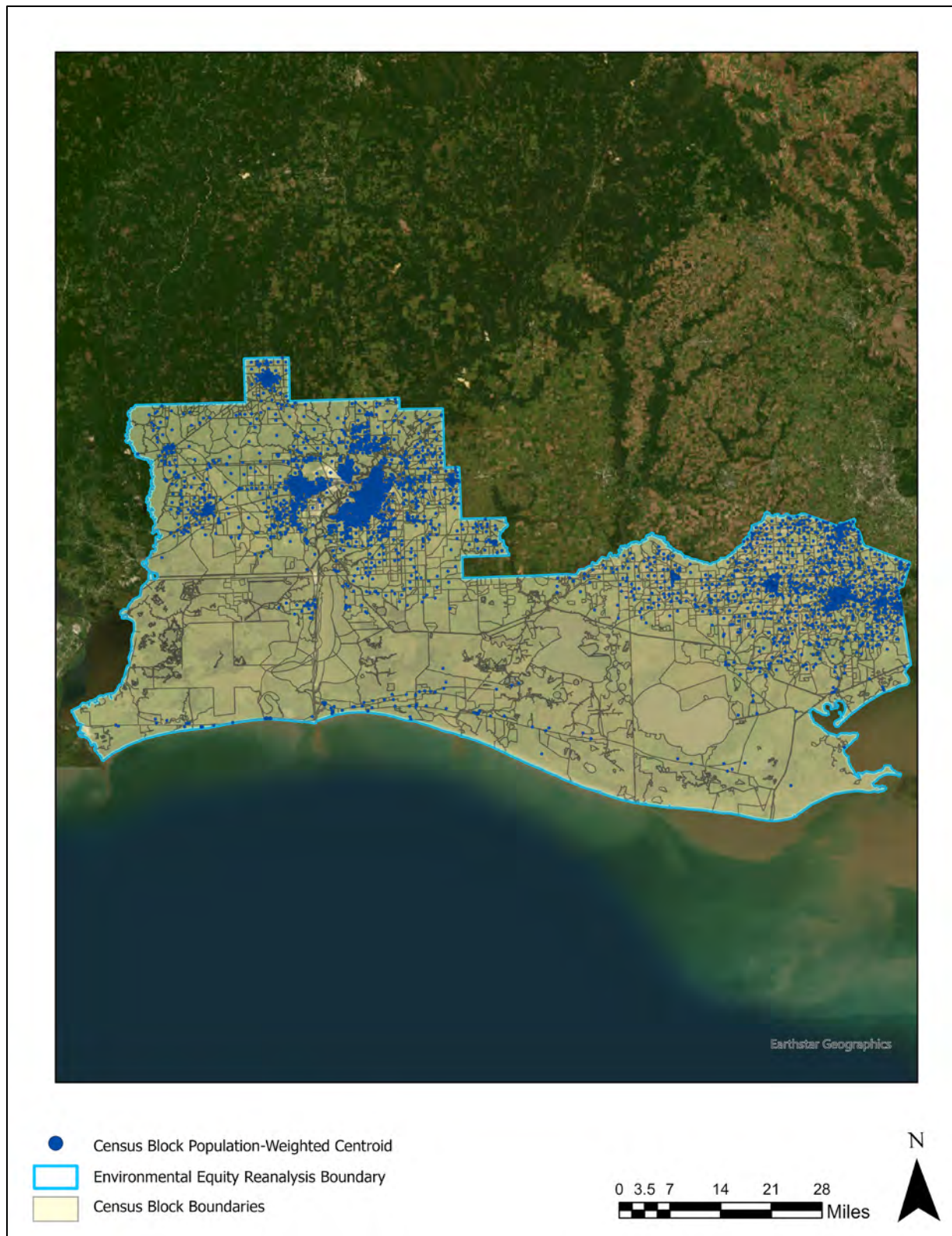


Figure 7-7. Southwest Coastal Louisiana boundary used for geostatistical environmental equity reanalysis (USACE, 2016a).



7.3.2.2 Results by Population Characteristics

An odds ratio of one indicates that the racial or ethnic group is as likely to reside within the ecosystem restoration benefit area as they are to reside outside of this area. Figure 7-8 demonstrates that residents identifying as Hawaiian are 1.48 times more likely to live within the benefit area than anywhere else in the reference area (the state of Louisiana). As a result, these groups are more likely to experience the potential benefits generated by the project.

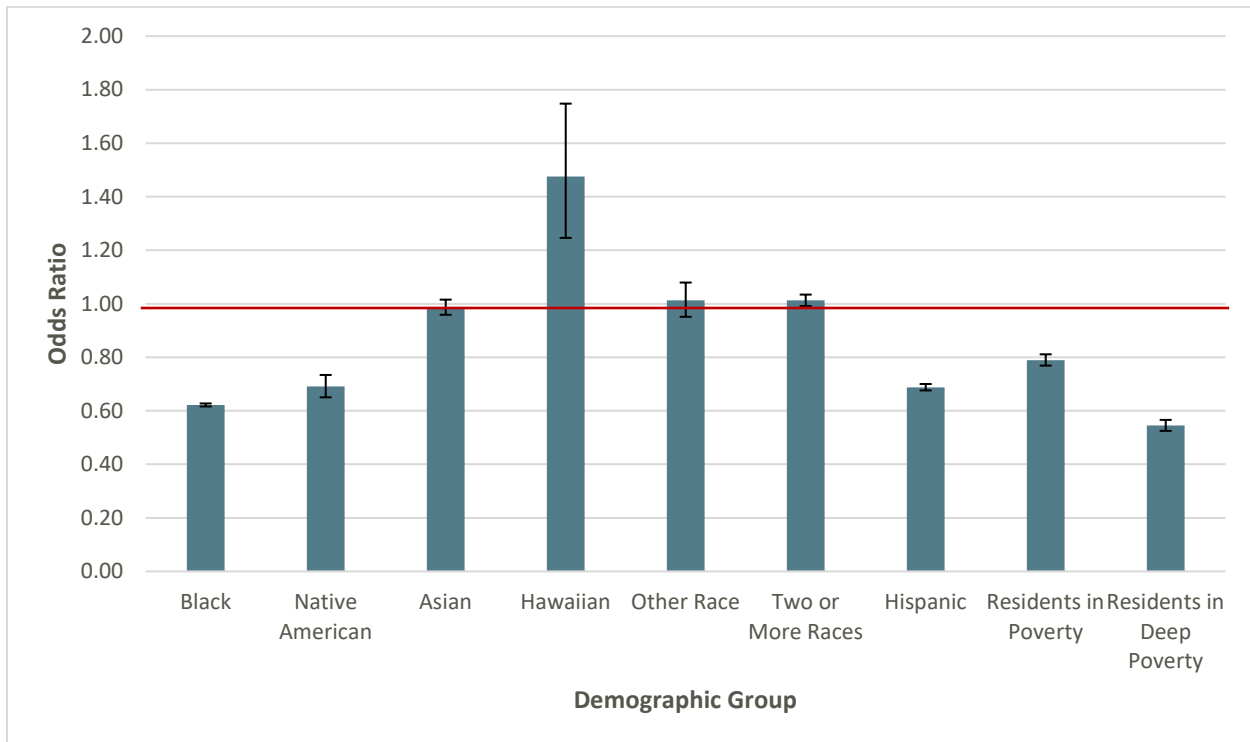


Figure 7-8. Odds ratios demonstrating the likelihood of demographic groups living inside the ecosystem restoration benefit area. The whiskers around each odds ratio in the figure represent 95% confidence intervals on the odds ratio. Only values for which the 95% confidence interval does not contain 1.0 are discussed in the text.

7.4. ANALYSIS OF EQUITY WEIGHTING IN BCA

7.4.1 Preceding BCA

7.4.1.1 Original Project BCA

The original USACE project calculated FRR benefits and cost across the entire study region as well as the costs associated with the NER portion of the project.

7.4.1.2 2023 Reanalysis

The 2023 reanalysis by the study team (Fischbach, Dalyander, McHugh, et al., 2023) added additional benefits due to carbon sequestration and ecosystem service wetlands value. However, these benefits were not carried forward into this equity weighted BCA process because the 1) dollar benefit of the sequestered carbon is based on a global value for removing carbon dioxide from the atmosphere and is not a spatially defined benefit and 2) the wetlands restoration value does not necessarily accrue to the populated areas of



these parishes, which are often located far from the restoration sites. As a result, the only analysis carried forward to the present BCA reanalysis is the FRR benefit.

7.4.2 BCA Recalculation and Updated Benefits

The first step in the benefit weighting process was allocating the existing calculated benefits between the different census block groups in the study area. The original USACE study did not provide a breakdown of benefits at this level of spatial resolution, so the study team applied three different assumptions: an even distribution of benefits, a weighted approach by the count of structures in each block group, and a weighted approach that uses the estimated value of structures in each block group. Income weights were then calculated relative to two reference incomes (unlike the other case studies no county reference income was used because the study domain is larger than a county).

A comparison across allocation methods and reference incomes is depicted in Figure 7-9. From the original benefit of \$203 million the weighted benefits increased for the state and US reference incomes (\$218–234 million and \$313–332 million respectively, depending on allocation method).

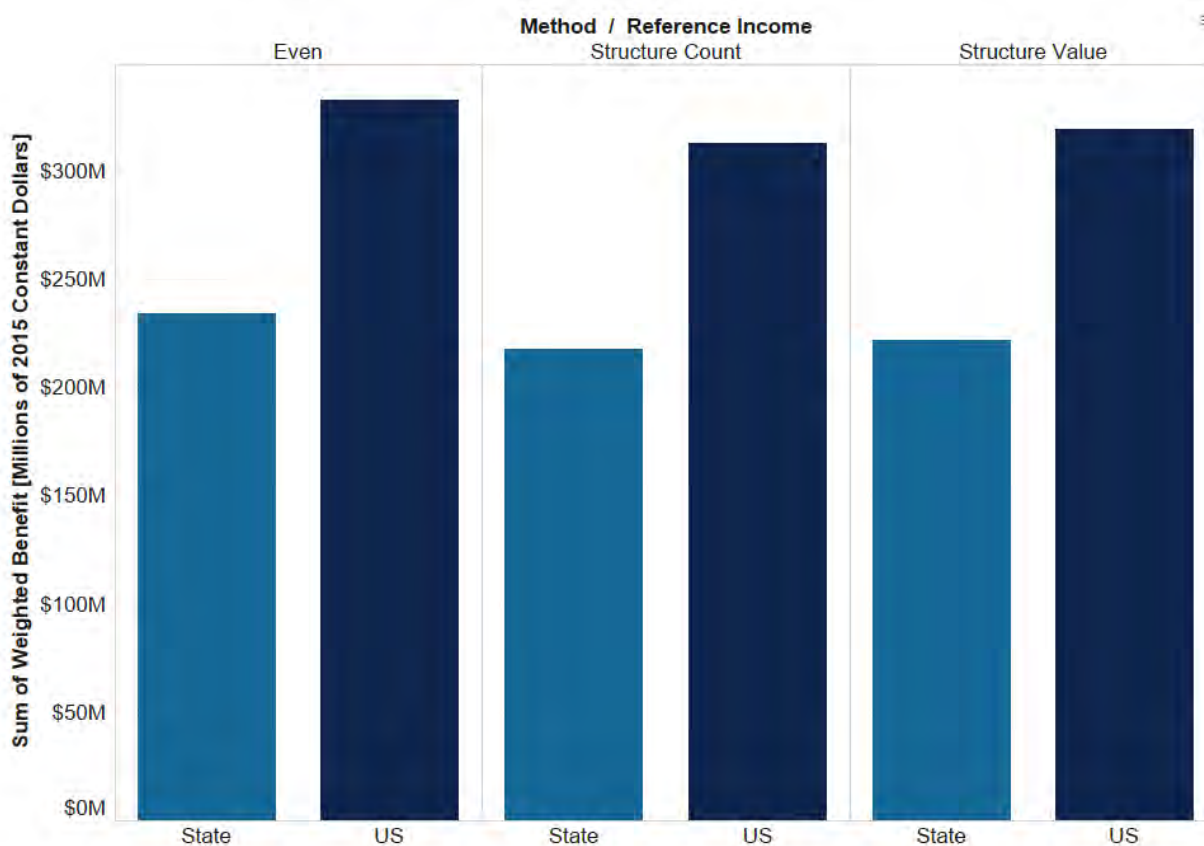


Figure 7-9 Weighted benefit by allocation method and reference income .

Demonstrating how the weighting approach changes the spatial distribution of benefits across the Southwest Coastal Louisiana FRR benefit area, the first pane of Figure 7-10, reading top to bottom,



shows the initial distribution of benefits allocated by the count of structures in each block group. The second pane shows the distribution of weights, calculated using block group income compared to county income as a reference point. The final pane shows the resulting weighted benefit from multiplying the initial benefits and weights.

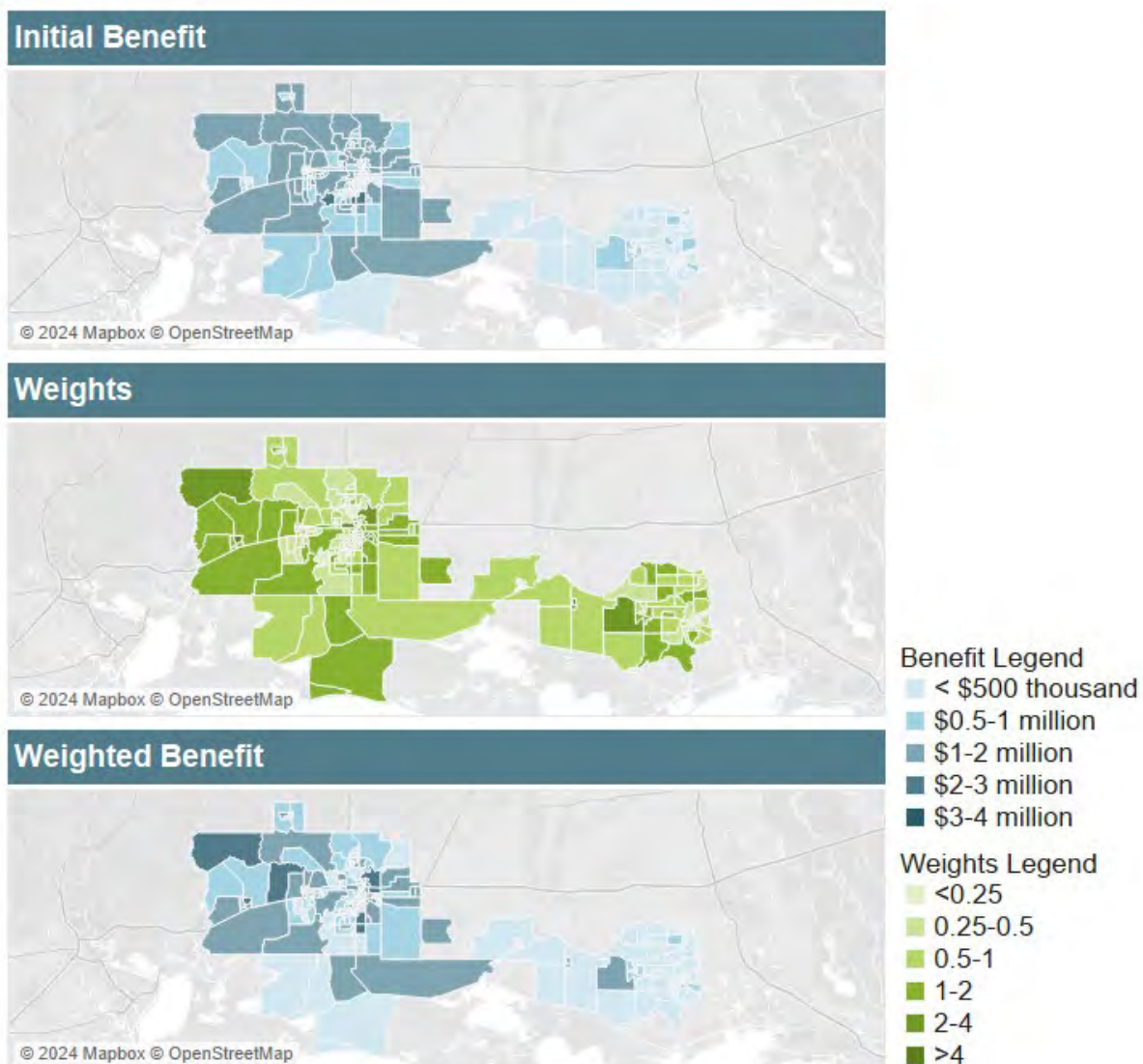


Figure 7-10. Spatial distribution of benefits and weights by block group.

Overall, the pattern of weights appears to be relatively highly correlated with the initial distribution of benefits, with the far western part of the project area having the highest weights and relatively high unweighted benefits. The far eastern edge shows the reverse pattern with the exception of a single census block group.

In general, the choice of allocation approach and reference income can also make a substantial difference in the spatial distribution of benefits. Figure A-28 shows weighted benefit mapped by block group for all



six combinations of allocation approach and reference income considered in this analysis. Weights rise substantially for all block groups as reference incomes increase from the state level to the US level. Due to the method of calculation the effect is not uniform across different block groups: block groups with the most extreme weights (high or low) are most affected by the choice of reference income. The effect of the benefit allocation is more spatially variable. For example, the maps show the pattern of development with respect to block group boundaries in how benefits shift westward in the allocation methods based on the structure inventory relative to the evenly weighted allocation method.

7.4.3 Weighted BCA Recalculation

The study reanalysis combined costs and benefits into two BCR values, one based on the project year water resources discount rate of 3.175% and one based on the OMB discount rate of 7%. The costs and benefits expressed as AAEQs and the BCR for these two discount rates for NED FRR benefits can be found in Table 6-2. Though the reanalysis included several additional sources of costs and benefits, these were excluded from the current calculation. In addition, Table 6-2 contains cost, unweighted benefit and BCR recalculated using a 2% discount rate. The effect of lowering the discount rate is to lower the AAEQ cost and thus raise the overall project BCR as compared to the values used in the original USACE analysis.

The same set of calculations was then performed using the weighted benefits (specifically the weighted benefits derived from the count of structures allocation method and the county reference income). These values can be found in Table 6-3. Note that because costs remain the same, the net effect of using weighted benefits is to increase the BCR regardless of discount rate.

Table 7-3. BCA values for the original study benefits for three different discount rates. All values in millions of dollars.

	Water Resources (3.175%)	OMB 1992 (7%)	OMB 2024 (2%)
Benefit (AAEQ)	\$203.5	\$203.5	\$203.5
Benefit (NPV)	\$5,067.7	\$2,809.2	\$6,396.4
Cost (AAEQ)	\$36.1	\$64.3	\$28.6
Cost (NPV)	\$897.7	\$887.9	\$900.7
BCR	5.64	3.16	7.10

Table 7-4. BCA values for the weighted benefits for three different discount rates. All values in millions of dollars.

	Water Resources (3.175%)	OMB 1992 (7%)	OMB 2024 (2%)
Benefit (AAEQ)	\$217.5 (\$217.5–\$332.6)	\$217.5 (\$217.5–\$332.6)	\$217.5 (\$217.5–\$332.6)
Benefit (NPV)	\$5,427.4 (\$5,427.4–\$8,265.5)	\$3,008.5 (\$3,008.5–\$4,581.8)	\$6,850.3 (\$6,850.3–\$10,432.6)
Cost (AAEQ)	\$36.1	\$64.3	\$28.6
Cost (NPV)	\$897.7	\$887.9	\$900.7
BCR	6.05 (6.05–9.21)	3.39 (3.39–5.16)	7.60 (7.60–11.58)



7.4.4 Discussion

The Southwest Coastal Louisiana project is the only case study for which the state reference income is lower than the national reference income. Thus, in contrast to all of the other case studies, using the national reference income increases the overall weighted benefits compared to the state reference income by a factor of 1.5, which in this case represents more than \$100 million in benefit. By contrast the substantially lower state reference income produces weighted incomes that are essentially unchanged from the initially calculated study benefits, reflecting the general resemblance of block group incomes in the study area to the overall state median household income.



8.0 JAMAICA BAY: HUDSON-RARITAN ESTUARY

8.1. INTRODUCTION

8.1.1 Study Area

The Hudson-Raritan Estuary (HRE) is an interconnected ecosystem of tidal rivers, straits, and bays that includes the Hudson and Passaic rivers, the East River, Arthur Kill Strait, Jamaica Bay, and Raritan Bay (Figure 8-1).⁹ Jamaica Bay, located between Brooklyn (Kings County) and Queens County on the southwestern tip of Long Island and East of New York Bay, connects to the bay through Rockaway Inlet. Jamaica Bay contains a large portion of Gateway National Recreation Area, which contributes to its complex urban ecosystem and provides the area with storm protection. The Jamaica Bay area also provides park and beach access to thousands of New York residents each year (USACE, 2020c).

In response to hundreds of years of urbanization and industrial pollution that caused habitat loss, poor water quality, and decreased public access (NOAA, 2019), the *HRE Ecosystem Restoration Feasibility Study* (USACE, 2020c) focused on opportunities for ecosystem restoration in five areas throughout the Hudson-Raritan Estuary. Because of the proximity of the proposed projects in the Jamaica Bay Planning Region of the study to the High Frequency Flood Risk Reduction Features (HFFRRFs) proposed in the 2019 *Hurricane Sandy General Reevaluation Report* (USACE, 2019c), the Jamaica Bay portion of the HRE study was selected for this reanalysis effort. The HFFRRFs from the 2019 report are included in a separate analysis in Chapter 9.0 of this report.

⁹ See Fischbach et al. (2023), Chapter 8, for more background information on this case study.



Figure 8-1. Study area: Jamaica Bay Planning Region, located within the Hudson-Raritan Estuary.



8.1.2 Demographics

The USACE study area for the HRE study encompassed eight different planning regions, and as such a smaller area was selected for this reanalysis. The reanalysis area referenced throughout this report includes the Jamaica Bay planning region outlined in Figure 8-1.

The recreation access benefit area identified for the Jamaica Bay HRE distributional equity analysis and BCA includes a series of smaller areas around the bay that were determined through a buffer analysis, in which 10-minute walking times from each Gateway National Recreation Area access point were calculated to determine access and therefore potential for disproportionate benefits to different racial, ethnic, and income groups.

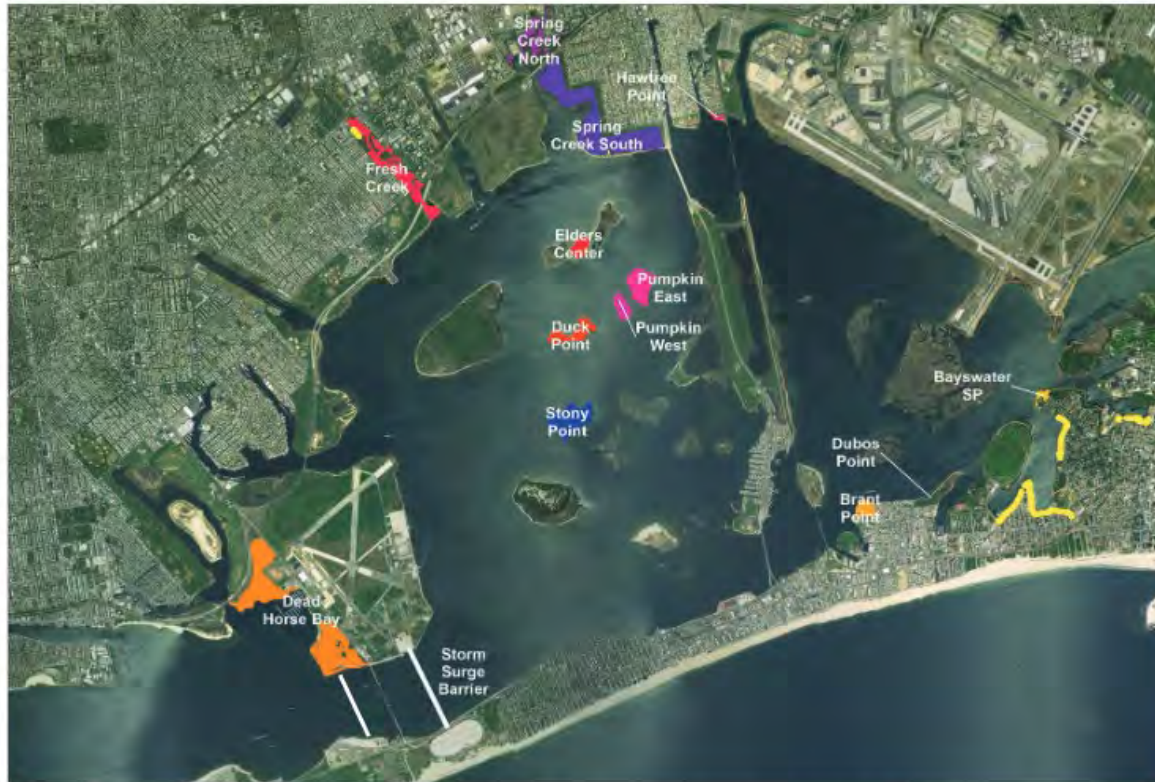
In the Jamaica Bay HRE recreation access benefit area, the three largest racial groups include people identifying as Black (63.7%), White (12%), and Other (11.9%). Residents in the recreation access benefit areas identifying as Hispanic total 21.2%. A higher percentage of Black residents live inside the FRR benefit area than outside (Table A-7).

8.1.3 Final Alternative

The final alternative for the Jamaica Bay planning region of the *HRE Ecosystem Restoration Feasibility Study* included marsh restoration for two perimeter sites (Dead Horse Bay and Fresh Creek) and five marsh island sites (Duck Point, Stony Creek, Pumpkin Patch East, Pumpkin Patch West, and Elders Center), as well as an oyster reef restoration projects at the Head of Jamaica Bay.



Figure 6.2
Map of Concept 1 Levers



NOTE: Proposed raised shoreline projects are indicated with yellow lines. Other distinct proposed projects considered in Concept 1 are denoted with their own unique color.

RAND RR2193-6.2

Figure 8-2. Jamaica Bay Hudson Raritan Estuary final alternative project sites (Fischbach et al., 2018). Note: this image also includes raised shoreline projects not included in the HRE final alternative.

8.2. PROCEDURAL EQUITY ANALYSIS

8.2.1 Analysis of Stakeholder Engagement

8.2.1.1 Scoping Process

The HRE Ecosystem Restoration study was preceded by several foundational efforts before it was formally scoped. In 2003, USACE held needs and opportunities workshops with regional stakeholders and partners, co-developed Target Ecosystem Characteristics (TECs) between 2004 and 2005, and closely collaborated with the Port Authority of New York and New Jersey and local stakeholders between 2006 and 2009 to develop a Comprehensive Restoration Plan (CRP; New York-New Jersey Harbor Estuary Program, 2009). This plan was created to serve as a guide for any future restoration work in the HRE.



The CRP was drafted in 2009 and adopted by the New York/New Jersey Harbor Estuary Program (HEP) to undergo further refinement from public input. USACE, HEP, and additional partners held public meetings between 2009 and 2012 in each of the HRE planning regions. These meetings were attended by the general public and representatives from over 100 stakeholder organizations. In May 2012, USACE and partners reconvened at a TEC workshop to review and integrate public comments from the initial outreach. The updated CRP was then re-released in 2016 (New York-New Jersey Harbor Estuary Program, 2016).

Following the release of the updated CRP and several working groups and planning conferences, the HRE Ecosystem Restoration study was then initiated as the mechanism for moving recommendations from the CRP forward by conducting further investigation and seeking congressional construction authorization.

Finally, the USACE project team and partners also maintained two study websites (one hosted by USACE and one hosted on harborestuary.org), to keep the public informed about progress and opportunities for public involvement.

Because no significant impacts were determined through a FONSI (finding of no significant impacts), there was no NOI.

8.2.2 Review of Public Comments

8.2.2.1 Stakeholder Comment Trends

The largest percentage of stakeholder comments on the Jamaica Bay HRE Study came from academia (32%), and several came from local government and NGOs (Figure 8-3). The majority were received through letter/postcard.

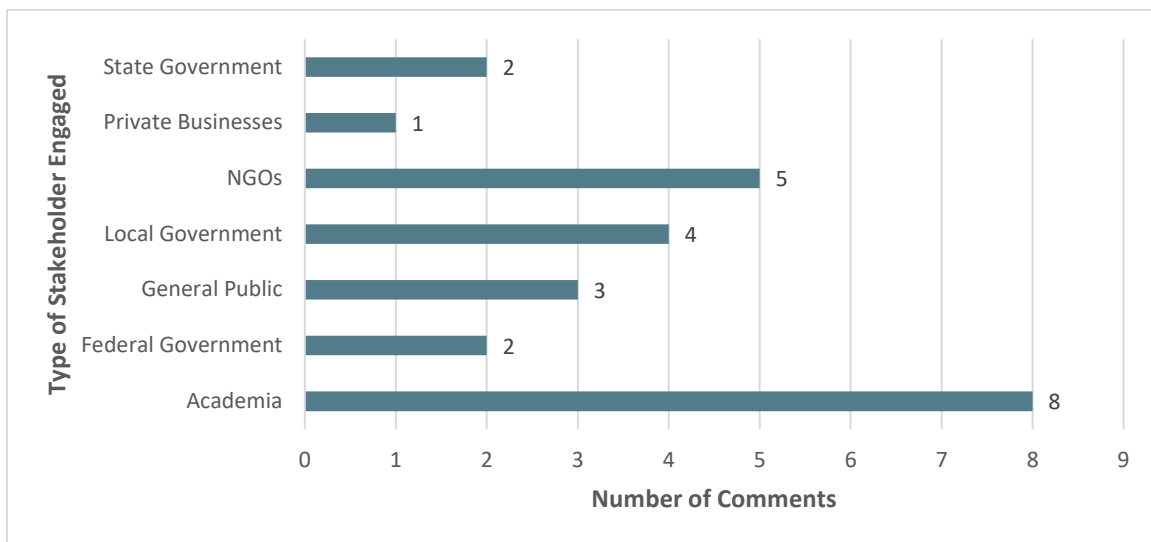


Figure 8-3. Types of stakeholder comments.

Original public comments were organized by type of organization (i.e., there was a section for academia, local government, state government, federal government, NGOs, private organizations, and a section with comments from public meetings).



USACE made some decisions that improved the accessibility of their public comment response. Specifically, in addition to including a response, they also included a comment summary (Figure 8-4).

USACE responded to all public comments that were submitted, but there are still opportunities to better understand and consider the details of those comments by summarizing more specific perceived benefits or costs. For example, a comment from a congressional representative was summarized as “support for work at Flushing Creek.” While this is true, this commenter also expressed preference for including two restoration measures from the “Alternative C” plan as they were “especially important to the communities we represent because they would improve water quality and alleviate noxious odors from the watershed.” It is important to note that this representative expressed hope that this plan would be strengthened for the final version of the report.

Another example of this is evident in how USACE responded to an academic organization that raised questions about oyster restoration at Head of Bay. This commenter was concerned about the approach to oyster restoration and recommended evaluating the current installation before expanding oyster restoration in the area. USACE responded to other parts of this commenter’s letter, but it was unclear whether this question about the approach to oyster restoration was considered or if it potentially got lost in the comment review process. A data-driven approach to comment review that codes responses and produces visuals could help to ensure that all comments are being accounted for, and that questions and concerns are thoroughly investigated.

Organization	Contact	Letter Date	Comment Summary	USACE Response
Representatives of Flushing, New York	Congresswoman Grace Meng (NY-6) Toby Ann Stavisky (NY State Senator) Ron Kim (NY State Assemblyman) Peter Koo (NY City Counselman)	1-May-17	Support for work at Flushing Creek	Thank you for your support.
Fifth Congressional District of NY	Congressman Gregory W. Meeks (NY-5)	4-May-18	Supports Ecowatcher's request to use sand from next maintenance dredging of Rockaway Inlet for marsh island restoration.	Thank you for your support. Dredged material will be used as the source of clean sand fill used to restore the Jamaica Bay Marsh Islands.
United States Environmental Protection Agency	Grace Musumeci (Chief, Environmental Review Section)	27-Apr-17	Support of HRE Draft FR/EA, provided EPA Greening recommendations, suggested coordination with other projects.	Thank you for your support of the HRE FR/EA. The District will look to incorporate the EPA Region 2 Green Recommendations during the PED phase.
United States Coast Guard	Jacob A. Hobson (Lieutenant Commander, US Coast Guard, Chief of Waterways Management Division)	6-Apr-17	Requested information for the First Coast Guard District and contacts regarding navigation buoys and navigational work.	Thank you for your comments. The District will reach out to the appropriate parties and provide needed information to comply with USCG requests. The District will ensure compliance with regulations regarding vessel anchorage and entry to the stated security zones during PED.

Figure 8-4. Organization of USACE response to public comments on report (USACE, 2020d).



8.2.2.2 Examples of Perceived Costs and Benefits

Because the Jamaica Bay HRE study was an ecosystem restoration study, there were few comments expressing concern or perceived costs related to projects.¹⁰ There were some questions about the high costs of implementing all the projects in this study, but these were framed as questions more than concerns. One major perceived benefit category reflected in public comments was “ecological benefits,” but there were several other perceived benefits that commenters were confident would occur because of the ecosystem restoration projects throughout the bay.

Most of the comments tagged as perceived benefits were related to ecological benefits (44%) and flood protection benefits (16%). The highest categories of perceived costs included ecological costs, flood protection costs, property value costs, economic costs, and recreational costs.¹¹

Table 8-1. Examples of segments extracted by USACE from comments that were coded as “Perceived Economic Costs (USACE, 2020d).

Segment
the effect that this project will have on flood insurance for homeowners was a concern
There are a number of locations in Arverne and Edgemere where the proposed permanent measure runs through the rear yards of occupied residential property. Although it may appear that there is enough space through a desktop analysis using GIS and Lidar, once surveys are produced, HPD believes that it is unlikely that that proposed alignment will be possible without additional condemnation. In particular, the proposed alignment in Edgemere, at the northern end of Beach 43rd street runs directly through the rear extensions of several homes. Moreover, the irregular shape of the alignment may have unpleasant impacts on the streetscape, drainage, and flooding. All of these will need to be addressed.
If there are residents and businesses in the project area, why are no allowances anticipated for relocation?

8.2.2.3 Public Concerns About Engagement

There were no comments expressing concern about engagement. However, there were a few comments recommending that USACE work closely with other agencies and organizations working on similar projects in the region to ensure that efforts would be coordinated and complementary.

There were 11 comments related to the quality of materials provided. Seven of those comments were requesting additional information, and four of them were expressing concern about incorrect data.

¹⁰ The project team only coded comments relating to the proposed projects in the Jamaica Bay Planning Region.

¹¹ Several comments related to perceived recreational costs were related to the Atlantic Shorefront interventions, which were not analyzed for this case study.



8.2.3 Discussion of Engagement Strategies

8.2.3.1 Engagement Practices Used by the USACE Project Team

To solicit public comments on the draft report, the New York District included a full page—which directly followed the title pages—detailing instructions for submitting public comments. This ensured that this information was immediately visible and did not get unintentionally overlooked in this 382-page report.

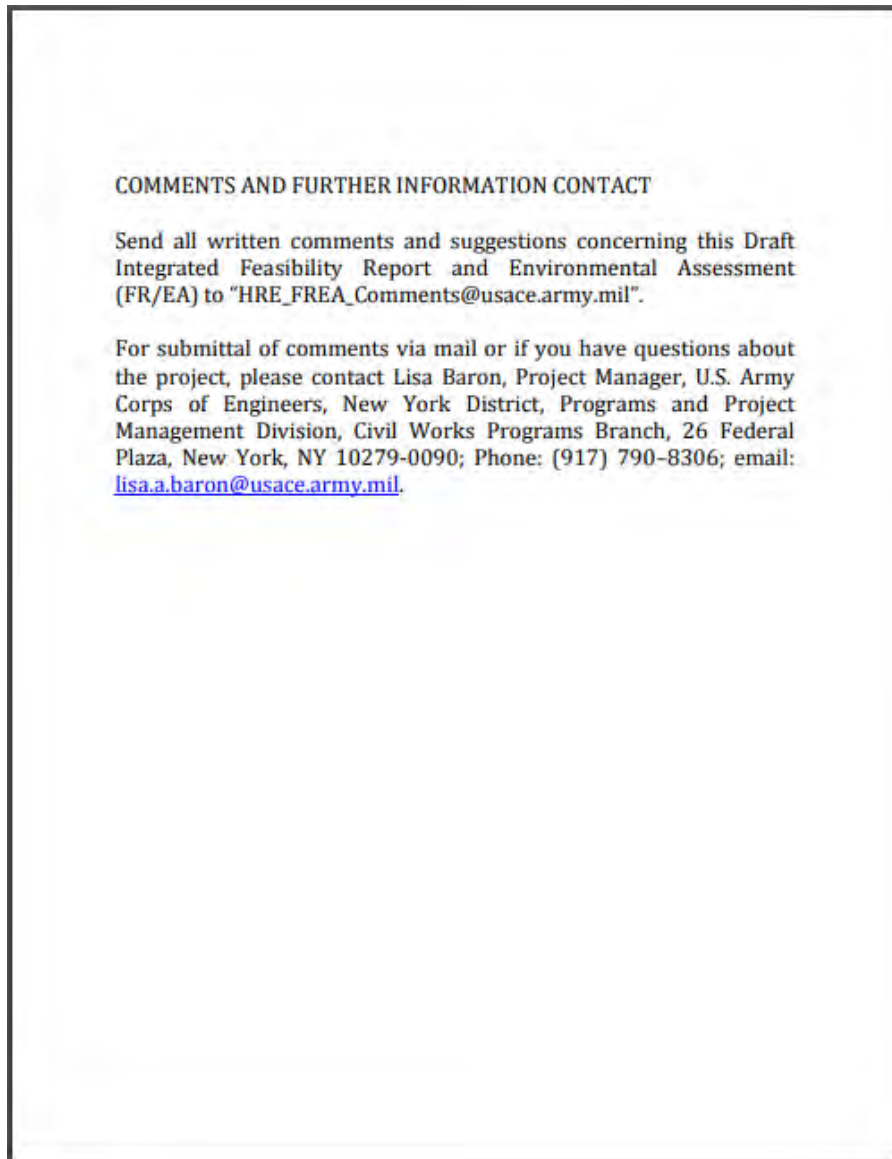


Figure 8-5. Instructions for submitting public comments (USACE, 2020c).

8.2.3.2 Future Opportunities for Innovative Engagement Strategies

If this study were to be conducted under more recent guidance from EO 14008, there could be additional opportunities to engage more residents in the study area during the release of the draft report and throughout the public comment period.



There was robust public engagement leading up to the draft feasibility study, but comments on the draft report came mostly from the academic community. Of all comments submitted on the draft report, only three came from the general public.

8.3. DISTRIBUTIONAL EQUITY ANALYSIS

8.3.1 EJ Analysis Conducted by USACE

Following federal, state, and local laws, regulations and policies that existed at the time this study was conducted (EO 12898), USACE measured disproportionate impacts and engaged in an extensive review of potential cumulative impacts from other projects in the area. Impact analyses related to disproportionate impacts were done for Potential Environmental Justice Area (PEJA) communities and were focused on harm reduction, but the USACE project team conducted additional analysis to inform plan selection. The project team assessed total population near restoration sites for a one-mile “halo” surrounding the project area, and used census block data to identify the population of minority residents and population with income less than the federal determination of poverty. The team then used the binary context of PEJA or non-PEJA based on New York state criteria, which allowed for prioritization based not only on the benefits produced by a project, but also the equitable allocation of those benefits among watershed residents (USACE, 2020b).

8.3.2 Geostatistical Environmental Equity Reanalysis

For the Jamaica Bay HRE reanalysis, the study team calculated potential disproportionate impacts within the project boundaries, which included densely populated areas both north and south of Jamaica Bay.

8.3.2.1 Impact Area Boundary Delineation

Impact area boundaries for the environmental equity reanalysis were determined by first applying the USACE-delineated study area boundary for the Jamaica Bay portion of the project, and then creating population-weighted centroids for each census block (for race and ethnicity) and for each census block group (for poverty status) that fell either partially or fully within the study area. Because of the nature of the decennial census, the finest scale of data for race and ethnicity is at the block level, and the finest scale of data for income is at the block group level.

These centroids were then used to determine whether a census block or block group would be included in the impact area. More simply, the process of determining population-weighted centroids was conducted to account for edge effects (e.g., it allows for the removal of census blocks or census block groups from the analysis whose population resides mostly outside the impact area). In the case of the Jamaica Bay HRE study, creating population-weighted centroids was critical to eliminating large census blocks that are either industrial areas or areas of open space where the population exists outside the reanalysis impact area boundary.



Figure 8-6. Jamaica Bay Hudson-Raritan Estuary boundary used for geostatistical environmental equity reanalysis (1/3).



Figure 8-7. Jamaica Bay Hudson-Raritan Estuary boundary used for geostatistical environmental equity reanalysis (2/3).



Figure 8-8. Jamaica Bay Hudson-Raritan Estuary boundary used for geostatistical environmental equity reanalysis (3/3).



8.3.2.2 Results by Population Characteristics

Demonstrating odds ratios for race/ethnicity at the block level and income at the block group level (Figure 8-9) indicates the likelihood that a specific population group will reside within a 10-minute walking distance of the project's recreational access points, as opposed to within the larger reference area (the Jamaica Bay study area) and could disproportionately benefit from the proposed project. A value of one indicates that the racial or ethnic group is as likely to live in the impact area as they are to live outside of it. For this project, the Black population is more than 2.5 times more likely to reside within walking distance of a recreational access point than they are anywhere else in the reference area.

Residents living below the poverty line are 1.57 times more likely to live within a 10-minute walking distance of the project than those who live outside this distance and therefore disproportionately benefitting from the recreational aspects of the project. Results for residents living in deep poverty are similar, with a slightly lower, odds ratio of 1.37.

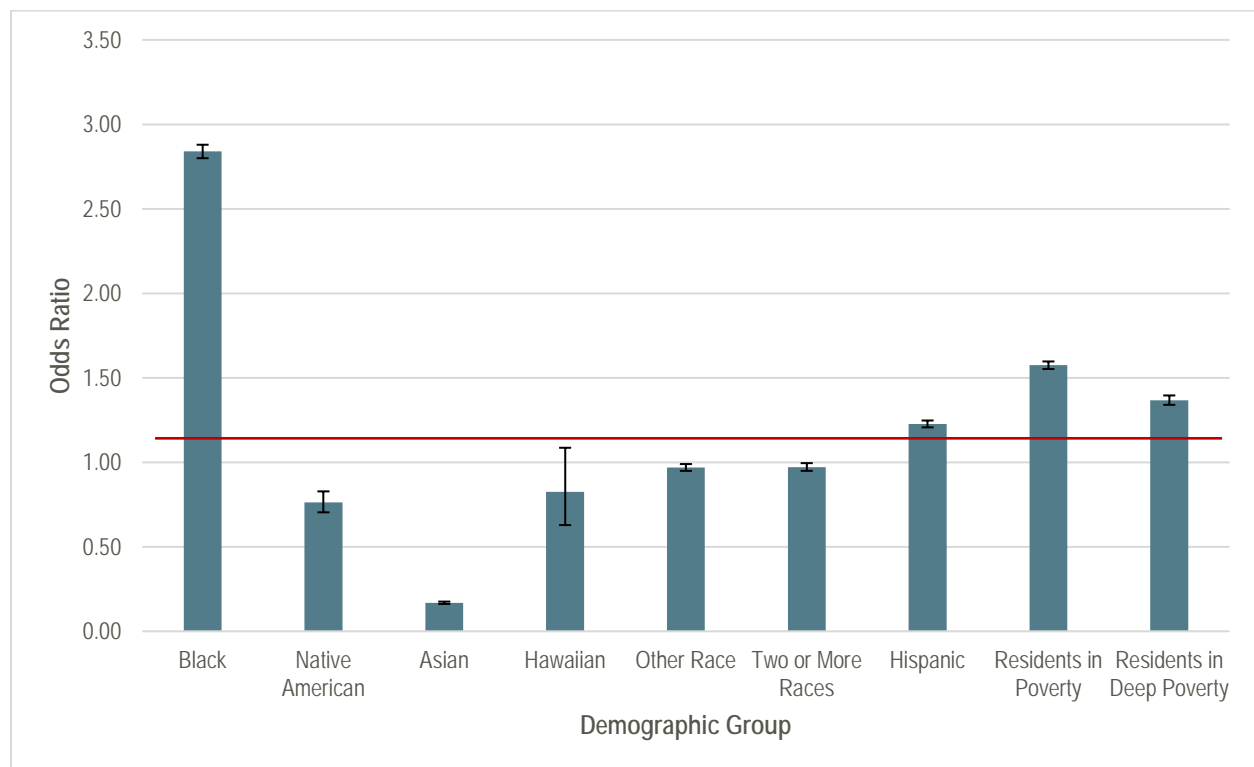


Figure 8-9. Odds ratios demonstrating the likelihood of demographic groups living inside the recreation access benefit area. The whiskers around each odds ratio in the figure represent 95% confidence intervals on the odds ratio. Only values for which the 95% confidence interval does not contain 1.0 are discussed in the text.

8.4. ANALYSIS OF EQUITY WEIGHTING IN BCA

8.4.1 Preceding BCAs

8.4.1.1 Original Project BCA

While the original project calculated costs for all components of the HRE restorations, no benefits were calculated by the USACE team (USACE, 2020c).



8.4.1.2 2023 Reanalysis

The 2023 reanalysis project calculated recreational benefits for the HRE projects using USACE UDV methodology (Fischbach, Dalyander, McHugh, et al., 2023). This methodology calculates a monetary value associated with a given day of usage of a particular area based on the properties of the area (e.g., access to fishing or recreational facilities) and then scales the value from a day of usage by the number of annual visitors to get a yearly value. The study team separately calculated UDV benefits for the perimeter and marsh island restoration projects. The marsh island sites were assumed to attract users from well outside the study area. As a result, the following draws only on the perimeter restoration UDV benefits.

8.4.2 BCA Recalculation and Updated Benefits

The first step in the analysis was to take the overall project benefit and allocate it across block groups in the study area. The original USACE study did not provide a breakdown of benefits at this level of spatial resolution (USACE, 2020c), so the study team applied weights proportional to the estimated population of each block group within the watershed. Income weights were calculated relative to three reference incomes. Choosing a higher reference income will increase weights given to all census blocks, while choosing a lower one will correspondingly decrease these weights. Weighted benefit increases relative to the unweighted value of \$292,000, regardless of the reference income used, reflecting the relative poverty of the census blocks in question. Weighted benefit is highest for the county reference (\$872,000) and lowest for the national reference (\$584,000).

Demonstrating how the weighting approach changes the spatial distribution of benefits across Jamaica Bay, the first pane of Figure 8-10, reading from left to right, shows the initial distribution of benefits allocated by the count of structures in each block group. The second pane shows the distribution of weights, calculated using block group income compared to state income as a reference point. The final pane shows the resulting weighted benefit from multiplying the initial benefits and weights.

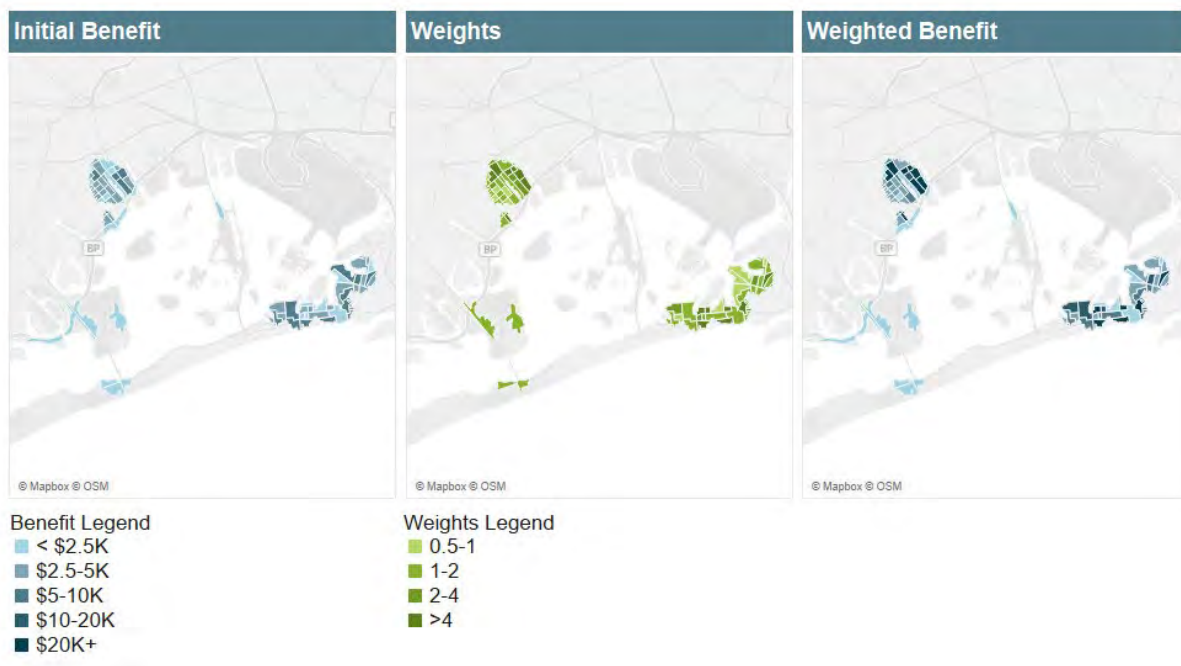




Figure 8-10. Spatial distribution of benefits and weights by block group.

Note that the spatial distribution does not shift greatly from the initial to income-weighted benefits, in large part due to correlation between the relative poverty of the various census block groups and the benefits as allocated to them by the population in the watershed. The weights across the census block groups also do not show very many extremely low values, hence the overall increase in benefit for all reference incomes. The block groups that have both relatively high weights and larger populations in the watershed tended to thus have relatively high benefit as estimated by this method.

8.4.3 Weighted BCA Recalculation

The original updated BCA combined costs and benefits into two BCR values, one based on the project year water resources discount rate of 2.75% and one based on the OMB discount rate of 7%. The costs and benefits expressed as AAEQ and the BCR for these two discount rates for the perimeter island UDV benefits can be found in Table 8-2. In addition, Table 8-2 contains cost, unweighted benefit and BCR recalculated using a 2% discount rate. The effect of lowering the discount rate is to lower AAEQ cost and thus raise the overall project BCR as compared to the values used in the original USACE analysis.

The same set of calculations was then performed using the weighted benefits (specifically the weighted benefits derived from the count of structures allocation method and the county reference income). These values can be found in Table 8-3. Note that because costs remain the same, the net effect of using weighted benefits is to increase the BCR regardless of discount rate, however this is not enough to offset the rather large cost relative to the calculated benefits for this project.

Table 8-2. BCA values for the benefit reanalysis for three different discount rates. All dollar values in thousands of dollars.

	Water Resources (2.75%)	OMB 1992 (7%)	OMB 2024 (2%)
Benefit AAEQ	\$292	\$292	\$292
Benefit NPV	\$7,891	\$4,033	\$9,184
Cost AAEQ	\$2,857	\$5,869	\$2,433
Cost NPV	\$77,145	\$81,004	\$76,467
BCR	0.10	0.05	0.12

Table 8-3. BCA values for the weighted benefits for three different discount rates. Values in parentheses represent the upper and lower bound across all assumptions about allocation and reference income. All dollar values in thousands of dollars.

	Water Resources (2.75%)	OMB 1992 (7%)	OMB 2024 (2%)
Benefit AAEQ	\$602 (\$584–\$872)	\$602 (\$584–\$872)	\$602 (\$584–\$872)
Benefit NPV	\$16,252 (\$15,766– \$23,541)	\$8,100 (\$8,060–\$12,034)	\$18,917 (\$18,351– \$27,401)
Cost AAEQ	\$2,857	\$5,869	\$2,433
Cost NPV	\$77,145	\$81,004	\$76,467
BCR	0.21 (0.20–0.31)	0.10 (0.10v0.15)	0.25 (0.24–0.36)



8.4.4 Discussion

The HRE portion of the Jamaica Bay project is the only case study which did not have any monetized benefits calculated in the original USACE analysis. Because these benefits were calculated using only data available after the fact and based solely on the UDV methodology, they are small relative to the overall cost of the HRE project. While the benefits doubled on average using the equity weighting methodology, this was still not enough to raise BCR values close to 1. This demonstrates the limitations of equity weighting methodology. Benefits are proportional to the unweighted benefits, so the higher the base value, the greater the impact (in absolute terms) of the equity weighting methodology.



9.0 JAMAICA BAY: HURRICANE SANDY GENERAL REEVALUATION REPORT

9.1. INTRODUCTION

9.1.1 Study Area

The Jamaica Bay study area (Figure 9-1) analyzed in the 2019 *Integrated Hurricane Sandy General Reevaluation Report* (HSGRR) includes both the Atlantic Coast between East Rockaway Inlet and Rockaway Inlet and the water and land surrounding and including Jamaica Bay, NY. The study area boundary delineated for this study and the Jamaica Bay study area boundary for the 2020 HRE study area one in the same. Unlike the 2020 HRE ecosystem restoration (ER) study, this 2019 study was a coastal storm risk management (CSRM) study focused on FRR features (both along the Atlantic Shorefront and within/surrounding Jamaica Bay) that would protect the communities and assets within the study area (USACE, 2019c). This case study analysis focused on the final recommended HFFRRFs, which were proposed for Mid-Rockaway and Cedarhurst-Lawrence (Figure 9-2).



Figure 9-1. Study area: Jamaica Bay (USACE, 2019c).



Figure 9-2. Locations of HFFRRFs in Mid-Rockaway and Cedarhurst-Lawrence (USACE, 2019c).

9.1.2 Demographics

The study area delineated by USACE for the HSGRR study informed the reanalysis reference area developed by the study team and discussed through this chapter.

The FRR benefit area identified for the distributional equity analysis and the benefits analysis includes the sub-basins located within Mid-Rockaway and the Cedarhurst-Lawrence sub-basin (Figure 9-2), as these were the boundaries used to measure costs and benefits of the HFFRRFs included in the recommended plan.

The population within the Mid-Rockaway FRR benefit area is racially and ethnically diverse; while the Cedarhurst-Lawrence FRR benefit area is small and relatively homogenous in comparison. In the Mid-Rockaway FRR benefit area, the three highest racial groups include residents that identify as Black (53%), White (16.3%), and Other (15.3%). 26.8% of residents in this area identify as Hispanic (Table A-8).

In the Cedarhurst-Lawrence FRR benefit area, White residents make up 83% of the total population, and the second and third largest racial groups are Other (7.8%) and Asian residents (4.3%). In the Cedarhurst-Lawrence FRR benefit area, 11.1% of residents identify as Hispanic (Table A-9).



9.1.3 Final Alternative

The selected set of HFFRRF projects (represented below in Figure 9-3, Figure 9-4, Figure 9-5, and Figure 9-6) identified for the final recommended plan included different combinations of berm, hybrid berm, bulkhead, floodwall, and NNBF features like stone toe protection, rock sill structures, regraded subtidal shoreline, and redesign of graded habitat in Mid-Rockaway, and deep bulkhead and a medium floodwall in Cedarhurst-Lawrence.

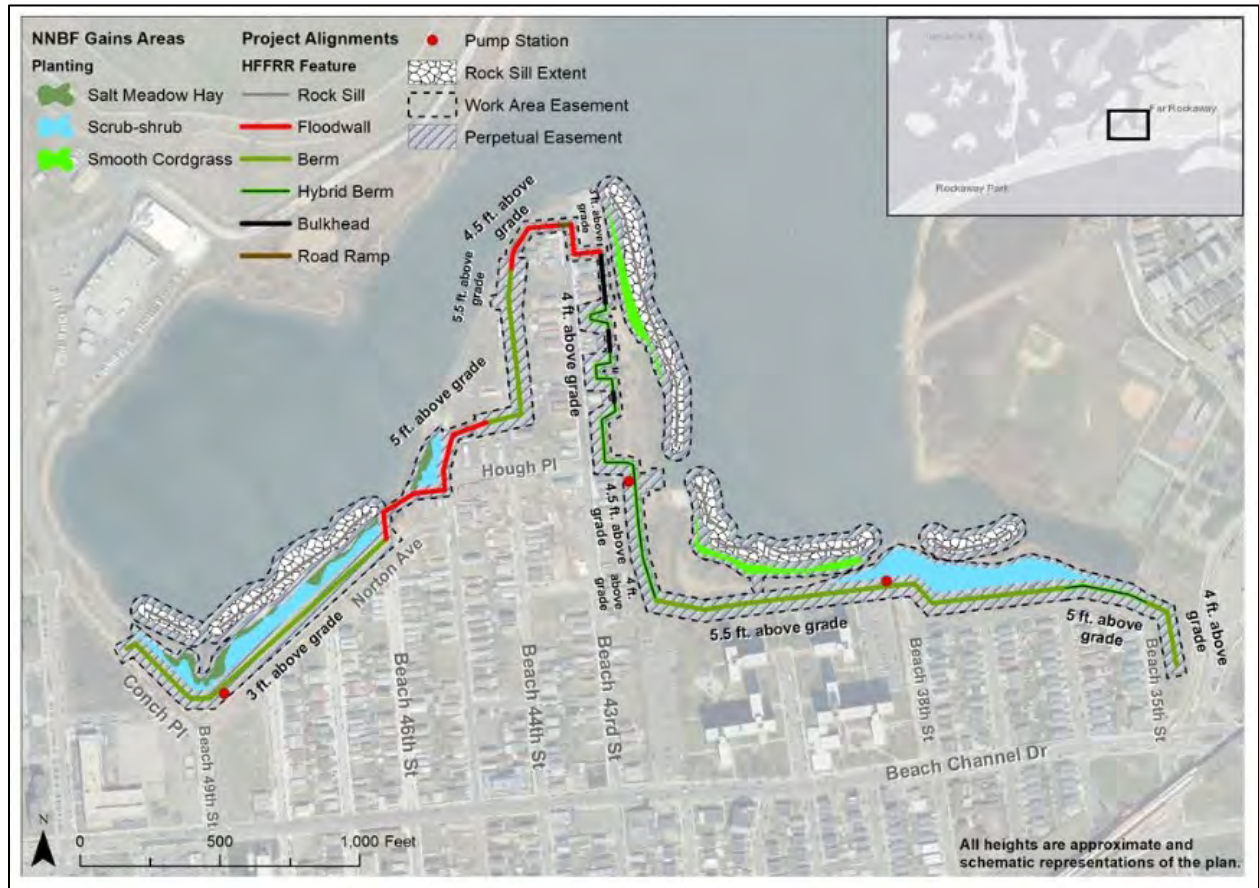


Figure 9-3. Mid-Rockaway: Edgemere final alternative (USACE, 2019c).

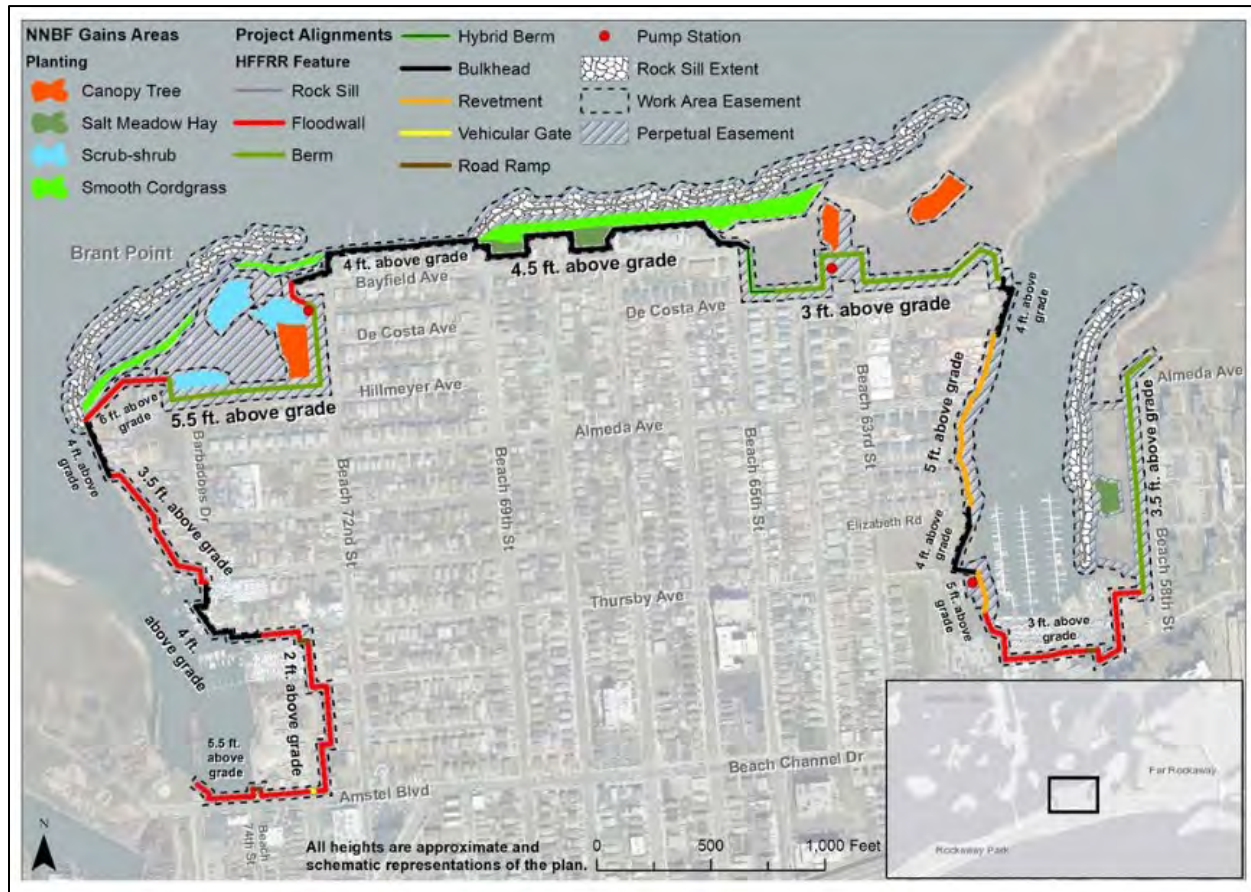


Figure 9-4. Mid-Rockaway: Arverne final alternative (USACE, 2019c).



Figure 9-5. Mid-Rockaway: Hammels final alternative (USACE, 2019c).



Figure 9-6. Cedarhurst-Lawrence final alternative (USACE, 2019c).

9.2. PROCEDURAL EQUITY ANALYSIS

9.2.1 Analysis of Stakeholder Engagement¹²

9.2.1.1 Scoping Process

In addition to distributing the NOI, the Jamaica Bay HSGRR project team also invited public comment on the scope of the proposed alternatives. Because Jamaica Bay is a densely populated area with many relevant and interested agencies and organizations, the scoping process was extensive and inclusive of many groups throughout Jamaica Bay. The project team received both oral and written input at public meetings and received written comments throughout the study process as well.

¹² The procedural analysis for the Jamaica Bay HSGRR considered comments related to both the Jamaica Bay projects and the Atlantic Shorefront projects.



9.2.2 Review of Public Comments

9.2.2.1 Stakeholder Comment Trends

The majority of stakeholder comments on the Jamaica Bay HSGRR Study came from the general public (41%), while the rest came from NGOs (34%), federal government, and local government (13% and 12%, respectively). A total of 210 Comments were received through public meetings, and 225 comments were sent in formally by government entities or NGOs (Figure 9-7).

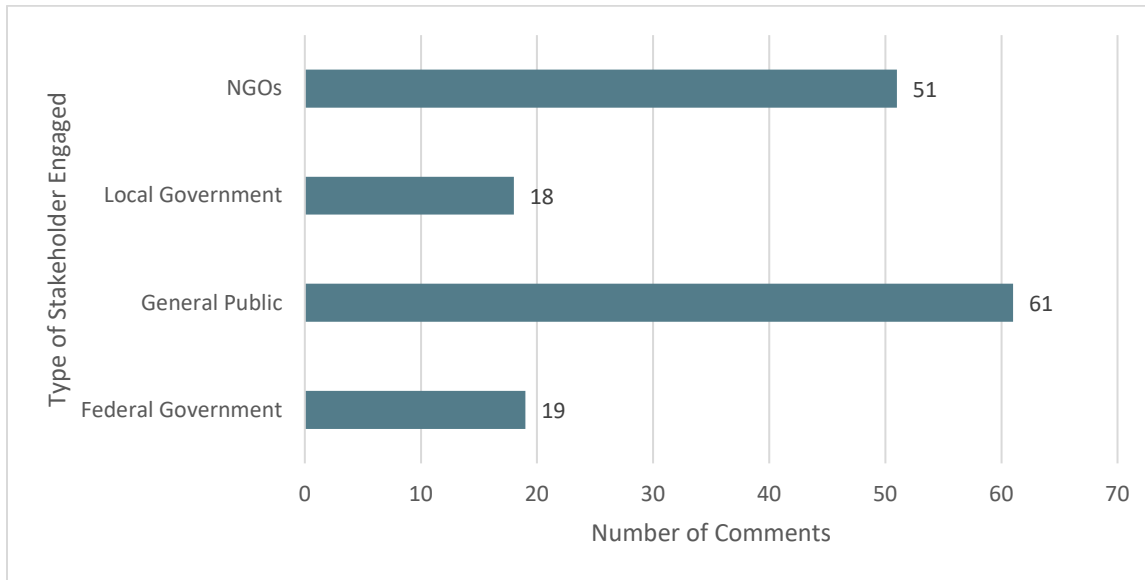


Figure 9-7. Types of stakeholder comments.

USACE organized comments into two groups: one group included government agencies and NGOs, and the other included the general public. USACE responses to public comments were thorough and addressed the root of each question, concern, or request for additional information (Figure 9-8).

Comments on the Rockaway Draft Integrated HSGRR and EIS

Page 55; Section 2.3.10 Water Quality, 1st paragraph: Paragraph indicates fecal coliform and E-coli data are from 1999 for the Atlantic Shorefront Reach. Is there any more recent data that can be used? Is it reasonable to assume and state that WQ is good when the geometric mean densities from 1989 through 1998 and reports from the NYC and Nassau Co. Public Health Departments from 1999 are referenced?

Response: Concur, more recent data on coliform and E-coli for the interior of Jamaica Bay is available and will be added to the Water Quality section of the report. Data covering 1997-2006 that was collected by the USEPA off Long Island will be incorporated into the analysis. The PDT will also be following up on data collected by the NYCDEP Harbor Survey. As necessary, the more recent data will be included in the revised Draft Final GRR/EIS.

Figure 9-8. Example of USACE response to government and NGO-submitted public comments on report (USACE, 2018).



Comment	Response
<p>I wanted to express concern over the revised draft provided by the army corps specifically about the lack of protection along Jamaica Bay/Beach Channel Drive from the intersection of BCD and Rockaway Freeway to BCD and 116th Street. As a property owner in the area I witnessed the flooding that took place along this stretch during Hurricane Sandy and am worried about the lack of protection in the area. Beach Channel Drive is after all our coastal evacuation route and when inundated with storm surge will almost certainly cause increased loss of life.</p> <p>Perhaps I am missing something in the study? What is being done to protect this area?</p> <p>Thank you for taking the time to read my comments.</p>	<p>Reg: comprehensive Jamaica Bay wide risk reduction features</p> <p>Given the low lying elevations of the Rockaway peninsula you cite, and the fact that the entire evacuation route would need to either be elevated or flooding kept out of it, comprehensive risk reduction would need a large-scale solution that covers the whole evacuation route in order to be effective. The proposed storm surge barrier (which is economically justified based on the preliminary analysis and is being studied under the NYNJHAT study now) would provide this comprehensive risk management and is the most cost effective alternative for this. However, it needs to be studied further before it could be implementable and the funding in the Sandy bill would not cover the ~\$3 billion cost of this feature, and would need further authority and funding in order to implement. In the interim, the Recommended Plan attempts to provide the feasible risk reduction for Back-Bay communities that can be accomplished under the existing study using existing funds.</p> <p>In the area you note, the Mid-Rockaway HFFRRF would reduce flood risk from smaller storms for Beach Channel Drive in much of the area you discuss. See Figure 2-3 in the Interior Drainage Sub-Appendix A2E which shows the drainage basins for Mid-Rockaway. Also, the parts of Beach Channel Drive behind the HFFRRF alignments for Mid-Rockaway would remain dry up to a 20% annual exceedance probability (AEP) event. However, for larger events major road closures are still expected. The pump stations that the project will install should, however, greatly improve the resiliency of the neighborhood and roads by allowing water to be pumped out of the neighborhood more quickly than it could naturally drain when water levels in the Bay remain elevated.</p>

Figure 9-9. Example of USACE response to report comments from the general public (USACE, 2018).

9.2.2.2 Examples of Perceived Costs and Benefits

The majority of the comments tagged as perceived benefits were related to flood protection (46%) and ecological benefits (30%). The highest categories of perceived costs included ecological costs (26%), flood protection costs (23%), recreational costs (15%), and economic costs (13%). One major perceived cost was impacts on recreation. Beach recreation accounts for a significant portion of New York City's economy and provides recreation for locals. Stakeholders were concerned about the potential impact of specific project features on beach access. However, this was in response to Atlantic Shorefront



interventions, which were not considered in the distributional equity analysis or analysis of equity weighting in BCA.

Table 9-1. Examples of segments extracted by USACE from comments that were coded as “Perceived Recreational Costs (USACE, 2018).

Segment
<p>Surfrider cannot support placing hardened structures such as the “composite dune”, proposed in this project, on the beach. When waves hit a seawall, the wave is reflected back towards the ocean taking beach sand with it. Both the beach and the surf may disappear. If high erosion or lack of funding allows the composite seawall to be uncovered, the structure will lead to the disappearance of the public beach in the Rockaways.</p>
<p>This small increase in overtopping and subsequent damage is worth the risk compared to the risk of losing the beach in the Rockaways if beach renourishment does not materialize through lack of sand, lack of funds, or lack of political will. If the hardened structures within the dune are exposed during a storm--and are not immediately covered back up--wave dynamics will rapidly destroy the beach.</p>
<p>Recreation/Tourism Impacts: The ocean economy in New York contributes \$22 billion per year in GDP, of which \$18 billion is attributed to the economic contributions of tourism and recreation. Surfrider completed a study in 2013 showing that when millions of annual New York beach goers visit our shores they spend an average of \$56 per person. This data can be viewed as an endorsement for continuing to nourish our valuable beaches, but it also serves as a warning that excessively engineered beaches put this economic driver at risk. At some point, sea level rise (SLR) will make beach nourishment untenable and residents will be forced to retreat, or live in a community encased in walls without beaches.</p>

9.2.2.3 Public Concerns About Engagement

There were a small number of comments expressing concern about engagement. The majority of these comments were related to unclear processes surrounding how to submit comments.

There were 31 comments related to the quality of materials provided. Of these comments, 18 were related to missing data, and the rest expressed concern about incorrect data and clarity of materials. There were 7 comments requesting additional information (Figure 9-10).

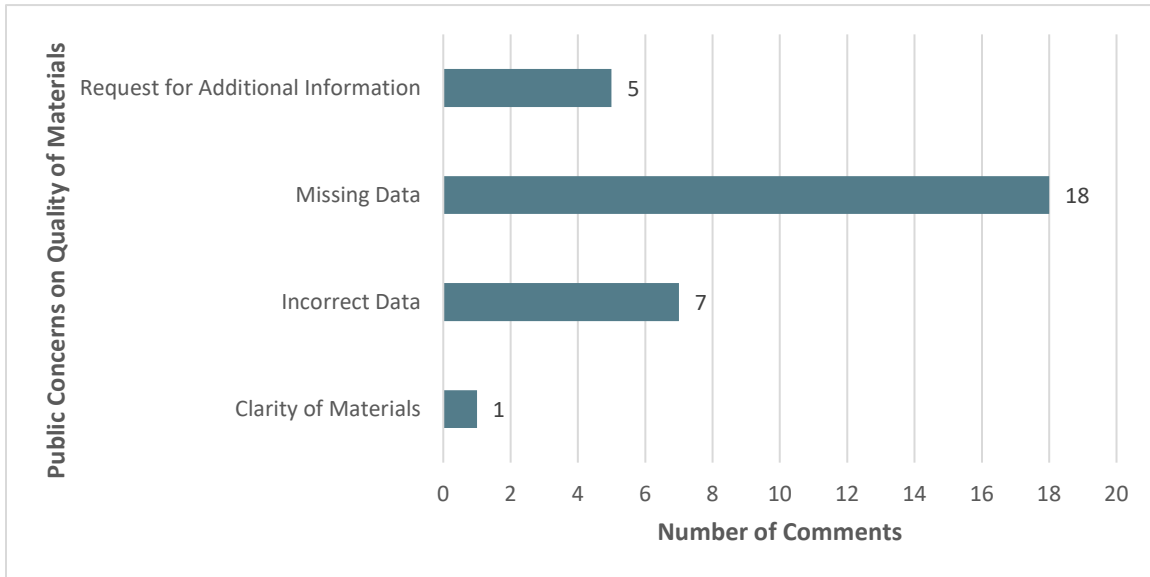


Figure 9-10. Public concerns on quality of materials.

9.2.3 Discussion of Engagement Strategies

9.2.3.1 Engagement Practices Used by the USACE Project Team

The USACE project team conducted extensive public engagement for this study. In addition to holding three NEPA scoping meetings, the USACE project team held seven public meetings to solicit feedback on the considered alternatives from the draft report. Over 400 attendees participated in the public meetings. However, there is an opportunity to consider how population density might help USACE project teams evaluate the level of reach for engagement efforts throughout the duration of a study. While 400 is a large number when it comes to public engagement, the relatively high population density in the Jamaica Bay study area when compared to other case studies in this analysis can be important to consider when defining what successful engagement looks like for USACE civil works projects.

9.2.3.2 Future Opportunities for Innovative Engagement Strategies

If this study were to be conducted under more recent guidance from EO 14008, there could be additional opportunities to track the amount of input received specifically from Tribal communities, communities identified as underserved or disadvantaged, communities with disproportionate numbers of households living below the federal poverty line, and people living with disabilities, and meaningfully synthesize and integrate this feedback into the planning process. For the Jamaica Bay HSGRR study specifically, engagement was comprehensive relative to many other civil works study engagement processes throughout the country and met the standards that were in place when the study was initiated. However, more robust tracking of the demographic groups reached could both meet the requirements of the EO and facilitate a more representative engagement process to produce more equitable outcomes.

9.3. DISTRIBUTIONAL EQUITY ANALYSIS

9.3.1 EJ Analysis Conducted by USACE

Following EO 12898 requirements, USACE identified and mapped PEJAs. Additionally, the USACE project team evaluated the potential long-term direct impacts of the recommended plan on PEJAs and



determined that the Atlantic Shorefront measures as well as the HFFRRF measures would provide benefits to areas with higher levels of poverty. The USACE project team also acknowledged that PEJA communities would likely experience adverse impacts from construction (sound above the ambient level, increased traffic, and traffic disruptions).

9.3.2 Geostatistical Environmental Equity Reanalysis¹³

For the Jamaica Bay HSGRR reanalysis, the study team calculated potential disproportionate impacts from flooding within two impact area boundaries: Mid-Rockaway and Cedarhurst Lawrence.

9.3.2.1 Impact Area Boundary Delineation

Impact area boundaries for the environmental equity reanalysis were determined by first applying the USACE-delineated sub-basin boundaries for Mid-Rockaway (all sub-basins in Mid-Rockaway were treated as one single boundary) and Cedarhurst Lawrence. The study team then developed population-weighted centroids for each census block (for race and ethnicity) and for each census block group (for poverty status) that fell either partially or fully within the study area. The centroids helped determine whether a census block or block group would be included in the impact area by eliminating census blocks and block groups that fell within the impact area but whose population densities were concentrated outside the impact area.

¹³ For the distributional analysis, the research team considered the final HFFRRFs proposed for Jamaica Bay in Mid-Rockaway and Cedarhurst-Lawrence.



Figure 9-11. Boundaries used for geostatistical environmental equity reanalysis: Mid-Rockaway.



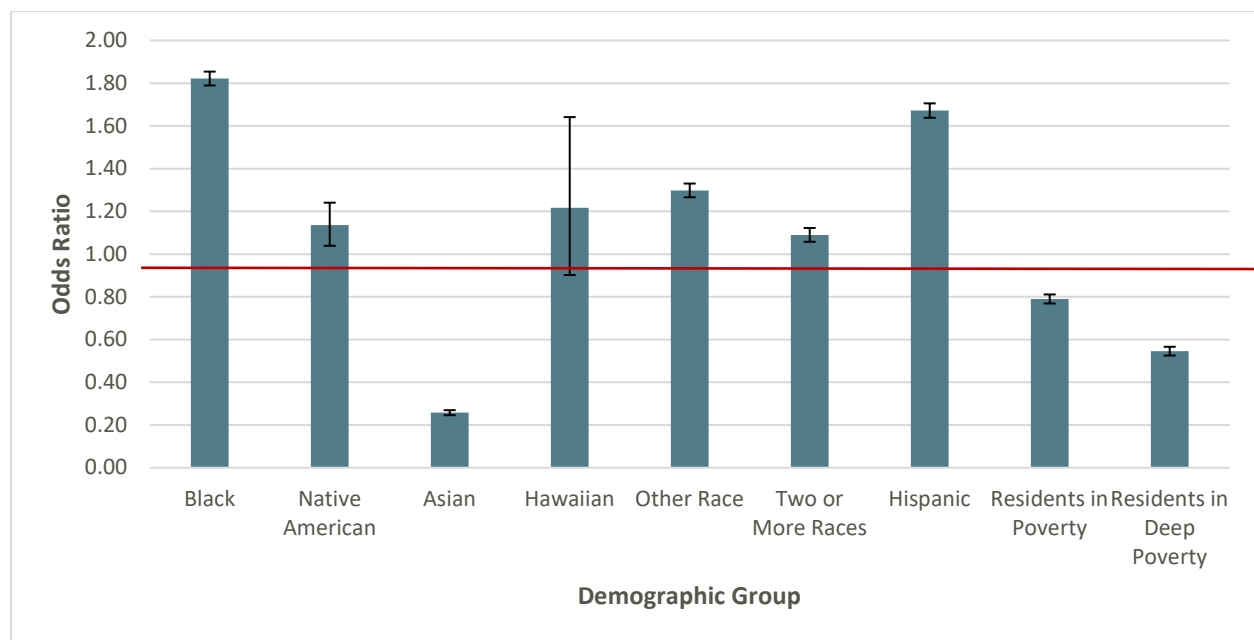
Figure 9-12. Boundaries used for geostatistical environmental equity reanalysis: Cedarhurst-Lawrence.



9.3.2.2 Results by Population Characteristics: Mid-Rockaway

Demonstrating odds ratios for race/ethnicity at the census block level and poverty status at the census block group level, Figure 9-13 below indicates the likelihood that a specific population group will reside within the FRR study areas, compared to the full Jamaica Bay and Hudson-Raritan Estuary reference area, and could disproportionately benefit from the proposed project. Because two separate FRR study areas contained HFFRRFs that were included in the recommended plan, odds ratios were calculated separately for each area (the Mid-Rockaway and Cedarhurst-Lawrence).¹⁴

In the case of Mid-Rockaway, the Black population is more than 1.8 times more likely, and the Hispanic population is almost 1.7 times more likely to live within the Mid-Rockaway FRR study area than they are to live in other locations in the reference area. These data also demonstrate that residents identifying as Other Race in the census form are more likely to live within the impact area and therefore are more likely to disproportionately benefit from the FRR aspects of the project. Given the high ratio of Hispanic residents, it is likely that many of those identifying as Other Race are Hispanic residents, which the US Census Bureau lists as an ethnic group, not a racial category.



¹⁴ Unlike the benefits analysis that follows, the distributional analysis treated Mid-Rockaway as one single basin because of the adjacency of all sub-basins within, and the fact that the USACE project team noted that the HFFRRFs deployed in this area would serve as protection across multiple sub-basins contained within Mid-Rockaway. The benefits analysis in the following section analyzes flood risk reduction benefits across the 7 sub-basins contained in Mid-Rockaway (Hammels 1, Hammels 2, Arverne 1, Arverne 2, Arverne 3, Edgemere 1, and Edgemere 2) to maintain consistency with the way that USACE reported flood damage outputs for each sub-basin.



Figure 9-13. Odds ratios demonstrating the likelihood of demographic groups living inside the FRR benefit area: Mid-Rockaway. The whiskers around each odds ratio in the figure represent 95% confidence intervals on the odds ratio. Only values for which the 95% confidence interval does not contain 1.0 are discussed in the text.

9.3.2.3 Results by Population Characteristics: Cedarhurst-Lawrence

Cedarhurst-Lawrence is a more demographically homogenous neighborhood compared to Mid-Rockaway; in this case, all non-White racial and ethnic groups represented in the distributional analysis are significantly less likely to reside in the Cedarhurst-Lawrence FRR study area than in the broader reference area and are therefore less likely to benefit from the FRR aspects of the project.

Residents in poverty and those in deep poverty within both the Mid-Rockaway and the Cedarhurst-Lawrence FRR study areas are significantly less likely to live within the FRR study areas than they are to reside in other locations throughout the full reference area. If this study were to be conducted under current Justice 40 requirements, there could be opportunities to consider the impact of such a small, sub-basin boundary on the flow of potential benefits (or lack thereof) to communities identified as disadvantaged.

9.4. ANALYSIS OF EQUITY WEIGHTING IN BCA

9.4.1 Preceding Benefit-Cost Analyses

9.4.1.1 Original Project BCA

The original project calculated costs and benefits for the Mid-Rockaway and Cedarhurst-Lawrence areas separately for each considered project and selected the most cost-effective plan for each project, resulting in a total of eight selected smaller projects (USACE, 2019c).

9.4.1.2 2023 Reanalysis

The 2023 reanalysis project took the overall cost and benefit calculated for the Mid-Rockaway project, as well as several additional benefits from the HRE side of the Jamaica Bay project and bundled them into the overall cost-benefit calculation used in the reanalysis (Fischbach, Dalyander, McHugh, et al., 2023). The additional UDV benefits, as well as the benefits calculated for the other project components for that analysis, are not included in the data presented below. Instead, for simplicity this reanalysis simply updates the originally calculated USACE benefits with the weighting methodology.

9.4.2 BCA Recalculation and Updated Benefits¹⁵

The first step in the analysis was to take the overall project benefit and allocate it across block groups in the study area. The original USACE study broke down the overall Mid-Rockaway benefits into eight distinct project footprints, however these footprints do not perfectly coincide with census block group boundaries. The study team applied three different assumptions to allocate the project level benefits to census block groups: an even distribution of benefits, a weighted approach by the count of structures in each block group, and a weighted approach that uses the estimated value of structures in each block

¹⁵ For the BCA recalculation, the research team considered the final HFFRRFs proposed for Jamaica Bay in Mid-Rockaway and Cedarhurst-Lawrence.



group. In some cases, a block group benefited from multiple projects, and the overall benefit to the block represented the sum of the benefits from the individual projects for that block group. Income weights were then calculated using three selected reference incomes.

Compared to the original benefits of \$5.4 million, the weighted benefits rose across all reference incomes and allocation methods (Figure 9-14). The increase was the smallest for US reference income (\$21–28 million depending on allocation method), higher for the state reference income (\$24–31 million depending on allocation method) and highest for the county reference income (\$32–42 million depending on allocation method).

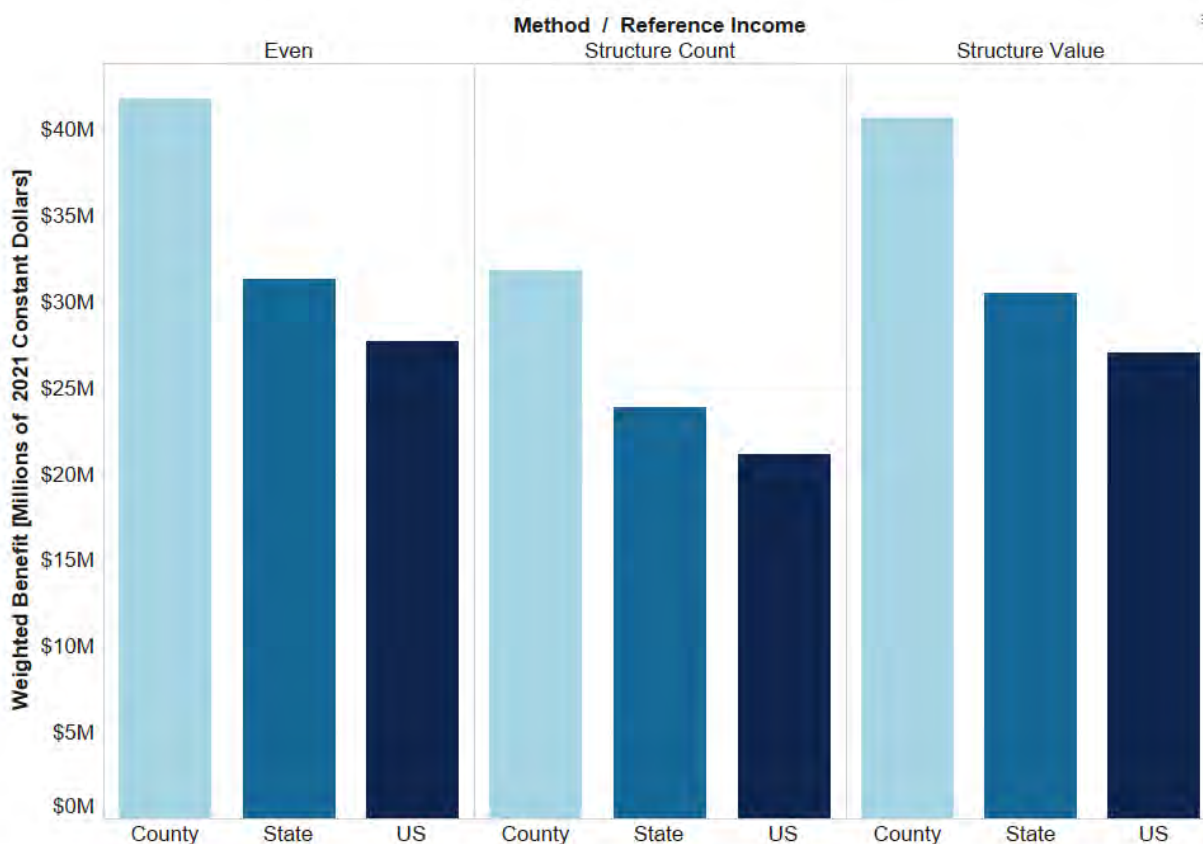


Figure 9-14. Weighted benefit by allocation method and reference income.

The weighting approach changes the spatial distribution of benefits across Jamaica Bay (Figure 9-15). The first pane shows the initial distribution of benefits allocated by the count of structures in each block group. The second pane shows the distribution of weights, calculated using block group income compared to state income as a reference point. The final pane shows the resulting weighted benefit from multiplying the initial benefits and weights.



Figure 9-15. Spatial distribution of benefits and weights by block group.

Note that the initial distribution of benefits is reasonably even, with only one block group being allocated more than \$1 million in benefit. The weights across the census blocks, however, vary substantially, with the highest weight being above 16 and no block group receiving a weight below 2. This produces both large shifts in the overall benefit as well as large magnitude shifts in which block groups have the highest weighted benefits. The highest weighted benefit block group is the same as the highest allocated benefit block group due to high weight, but several other block groups come close to it in weighted benefit.

In general, the choice of allocation approach and reference income can also make a substantial difference in the spatial distribution of benefits. Figure A-43 shows weighted benefit mapped by block group for all nine combinations of allocation approach and reference income considered in this analysis. Weights fall sharply for all block groups as reference incomes decrease from the county to the state level, and fall less dramatically for all block groups when the reference income is set to the US level. Notably, due to the method of calculation, the effect is not uniform across different block groups: block groups with the most extreme weights (high or low) are most affected by the choice of reference income. The effect of the benefit allocation is more spatially variable, but for example, the maps reveal the source of the increase in benefits for the even and structure value approaches appears to come from allocating benefit more evenly across the central part of the overall project area to put more value in higher weight block groups.



The next section brings together weighted benefit and cost and compares against the original BCA calculation.

9.4.3 Weighted BCA Recalculation

The original updated BCA combined costs and benefits into two BCR values, one based on the project year water resources discount rate of 2.75% and one based on the OMB discount rate of 7%. However, that analysis included benefits from NNBFs in the final Mid-Rockaway plan that were not included in the equity weighting analysis. Thus, the costs and benefits and associated BCRs were recalculated for the present study. The costs and benefits expressed as AAEQs and the BCR for these two discount rates for the HFFRRF projects can be found in Table 9-2. In addition, this table contains cost, unweighted benefit and BCR recalculated using a 2% discount rate. The effect of lowering the discount rate is to AAEQ cost and thus raise the overall project BCR as compared to the values used in the original USACE analysis (USACE, 2019c).

The same set of calculations was then performed using the weighted benefits (specifically the weighted benefits derived from the count of structures allocation method and the county reference income). These values can be found in Table 9-3. Note that because costs remain the same, the net effect of using weighted benefits is to increase the BCR regardless of discount rate.

Table 9-2. BCA values for the benefit reanalysis for three different discount rates. All dollar values in millions of dollars.

	Water Resources (2.75%)	OMB 1992 (7%)	OMB 2024 (2%)
Benefit AAEQ	\$5.4	\$5.4	\$5.4
Benefit NPV	\$145.6	\$74.4	\$169.4
Cost AAEQ	\$2.4	\$9.1	\$1.9
Cost NPV	\$66.0	\$125.6	\$58.8
BCR	2.20	0.59	2.88

Table 9-3. BCA values for the weighted benefits for three different discount rates. Values in parentheses represent the upper and lower bound across all assumptions about allocation and reference income. All dollar values in millions of dollars.

	Water Resources (2.75%)	OMB 1992 (7%)	OMB 2024 (2%)
Benefit AAEQ	\$23.9 (\$21.1–\$41.8)	\$23.9 (\$21.1–\$41.8)	\$23.9 (\$21.1–\$41.8)
Benefit NPV	\$644.6 (\$570.5–\$1,127.5)	\$329.5 (\$291.6–\$576.4)	\$750.3 (\$664.0–\$1,312.4)
Cost AAEQ	\$2.4	\$9.1	\$1.9
Cost NPV	\$66.0	\$125.6	\$58.8
BCR	9.76 (8.63–17.07)	2.62 (2.32–4.59)	12.7 (11.3–22.32)

9.4.4 Discussion

The Jamaica Bay HFFRRF project demonstrates the effect of income weighting on communities where incomes are low, not just in comparison to the national median household income (\$74,000), but even more so in comparison to their county and state median household incomes (\$99,000 and \$81,000



respectively). Even under the national reference income there is no census block group in the study area that has a weight of less than 1. The effect of this is to markedly increase benefits regardless of the reference income or allocation method used (by at least a factor of 4). While the project was originally calculated as providing more benefit than it cost under both the water resources and OMB 2024 discount rates, the effect of adding the additional benefits form weighting is enough to move it from having benefits that were outweighed by costs under the OMB 1997 discount rate to having benefits that outweigh costs by a factor of at least two.



10.0 CROSS-CUTTING ANALYSIS

10.1. INTRODUCTION

This report aims to test how different analytical methods can support the evolving federal focus on equitable distribution of benefits to disadvantaged communities. Through six case studies, the study team explored the application of these methods for different kinds of benefits and different project contexts. This chapter provides some key findings and opportunities for the three different dimensions of equity analysis applied to the case studies. While the study team attempted to use all information that would have been available to USACE during the feasibility studies, there may be outstanding documentation or model outputs that would change some of these findings. This is one of the challenges inherent in a retrospective review. It is also important to acknowledge that methods evolve as data become more easily available and accessible, and processing becomes easier and more efficient. Where possible, this chapter will identify opportunities to use these analytical methods at earlier stages, to inform overall decision-making and prioritization in service of the goals outlined in guidance and statute.

Throughout this chapter analyzing findings across all case studies, the persistent theme is the need for decision framing and explicit discussions of what is important to measure. The guidance from EOs and agencies is not prescriptive, nor are these methods; they can be applied in different ways and different contexts depending on values and judgements, which vary from individual to individual, and analytical choices, which involve a set of assumptions and methods that require scrutiny and review. In all cases, analytical choices ultimately made by a decision maker—such as a boundary of impact or the median income used as a reference point—have the potential to notably change the final estimates of quantified benefit. As a result, USACE has the opportunity to provide additional guidance on how these analytical choices should support and guide planning studies.

10.2. PROCEDURAL EQUITY ANALYSIS

10.2.1 Key Findings

The value of public involvement in the NEPA process is significantly limited by the structure and timing of its public participation provisions (Outka, 2006). Additionally, the pro forma nature of public participation activities mandated under NEPA often makes residents feel as though they are part of a scripted process, leaving little room for their input to be integrated into decision-making (Ulibarri et al., 2022). Despite these shortcomings, traditional participatory approaches, such as public notice and comment periods, remain the primary engagement tools used by most federal agencies (Daley & Reames, 2015). CEQ guidance documents recognize the inadequacy of these methods and suggest that new approaches could lead agencies toward more meaningful engagement (Outka, 2006). Consequently, agencies like the EPA, DOE, and DOT have increasingly relied on citizen advisory groups and site-specific advisory boards that accurately reflect community demographics when engaging with the public. The EPA has utilized community forums and listening sessions, along with developing integrated communication technologies, to further expand participation. These tools enable the agency to regularly hold outreach calls with potentially impacted communities to gather and address public concerns (Daley & Reames, 2015). Similarly, the DOT has enhanced public participation through technology, employing an electronic participatory mechanism called EJ Ideascale, which allows the public to submit ideas and



view and respond to comments from others (Daley & Reames, 2015). Despite these advancements, incorporating stakeholder feedback into agency-wide strategies remains challenging for federal agencies due to the minimal guidance provided on analyzing and addressing conflicting input from a diverse public.

Several key findings emerged from the procedural equity analyses of the six case studies. First, the use of tools like MaxQDA to code public comments allowed the study team to scope potential social outcomes, both positive and negative, not usually identified through other quantitative assessments. By using key word coding and producing visuals to demonstrate comment trends, these social outcomes, as well as additional benefits and costs perceived by community members, can be summarized and tracked. This valuable information can provide insight into tradeoffs before a final alternative is selected (Figure 5-5).

A consistent challenge across the case studies is the mismatch between the populations who submit comments and the populations identified within an impact or benefit area. Even when public engagement is extensive and thoroughly documented, communities that would potentially be impacted by a project still may not be aware of the project, its impacts, or its proposed benefits. Without additional information on who is engaging in these processes, it is difficult for USACE to know whether they are reaching communities within their benefit or impact boundary.

Additionally, there were difficulties tracking where and how public feedback was incorporated into the final plan. Figure 9-8 from the *Jamaica Bay Hurricane Sandy Reevaluation* report (USACE, 2019c) demonstrates a more thorough response to public comments; as it indicates which parts of the commenter's concern will be incorporated into the revised draft final report. However, tracking and communicating where and how public comments did inform edits to revised reports could both increase public confidence in USACE engagement processes and provide USACE project teams with quantitative data to measure the success of engagement efforts throughout the project lifecycle.

Finally, the study team identified the value of a procedural equity engagement checklist for tracking some key components of equitable engagement. This checklist is not exhaustive and project needs vary across different locations, business lines, and other contexts, but a checklist like this might serve as a tool in future engagement planning to help project teams track their efforts in reaching populations that will potentially benefit from or be impacted by a prospective project. Table 10-1 below demonstrates procedural engagement activities conducted under each of the six case studies described in the previous chapters.¹⁶

¹⁶ Note: Due to the limitations present in an analysis like this, there were several instances where the status of procedural engagement activities for a given case study was unknown. For example, information on non-NEPA and informal outreach activities were not identified in the case study reports and therefore not listed here. This checklist below is not meant to serve as a strict reanalysis, but rather demonstrate how it could be used in the future.



Table 10-1. Procedural equity engagement checklist: Public notice.

“	Case Study ¹⁷											
	S. SF Bay		W. Sac.		S. Platte		SWCLA		HRE		HSGRR	
	Scoping	Report D _{scop}	Scoping	Report D _{scop}	Scoping	Report D _{scop}	Scoping	Report D _{scop}	Scoping	Report D _{scop}	Scoping	Report D _{scop}
Public Notice												
Distribution of NOI												
The federal register and state clearinghouse	X	-	X	-	X	-	X	-	* ¹⁸	-	X	-
Relevant NGOs and/or regional organizations	X	-	X	-		-	X	-	-	-	X	-
Residents and local stakeholders (i.e., was notice sent to neighborhood organizations, schools, etc.)		-	X	-		-		-	-	-	X	-
Tribal governments		-		-		-		-	-	-		-
Communities identified as underserved		-		-		-		-	-	-		-
Were there any discussions with stakeholders at the time the NOI was distributed?		-		-		-		-	-	-		-
Accessibility												
Did the public notice make clear where/how to send comments?	X	-		-	X	-	X	-	-	-	X	-
Was public notice translated into multiple languages?		-		-		-		-	-	-		-

¹⁷ Note: a hyphen indicates that the question does not apply to this phase of public engagement. A blank cell indicates “No” or “Unknown.”

¹⁸ A FONSI was issued for this study, and therefore public notice questions did not apply to this analysis.



Table 10-2. Procedural equity engagement checklist: Public meetings.

“	Case Study											
	S. SF Bay		W. Sac.		S. Platte		SWCLA		HRE		HSGRR	
	Scoping	Report Draft	Scoping	Report Draft	Scoping	Report Draft	Scoping	Report Draft	Scoping	Report Draft	Scoping	Report Draft
Public Meetings												
Meeting Notice												
Was a public meeting held?	X	X	X	X		X	X	X	X	X	X	X
Were public meetings announced through multiple avenues? (e.g., letter, email, social media, city website, etc.)	X		X	X		X	X	X	X	X	X	X
Were underserved communities notified of the public meeting?												
Translation												
Was the public meeting notice translated into multiple languages?												
Were meeting presentations and materials translated into multiple languages?												
Accessibility												
Were meetings in-person?	X	X	X	X		X	X	X		X	X	X
Was more than one meeting held?			X	X		X	X	X		X	X	X
Were meetings held after 5pm and/or within non-traditional business hours (e.g. weekends, booths at existing public events)?	X		X			X	X	X		X		
Were meetings held in more than one location to accommodate diverse neighborhoods within the potentially impacted area?						X	X	X			X	X
Was the meeting space accessible by public transit?	X		X	X		X				X	X	X
Was the meeting space ADA accessible?	X		X	X		X			X	X	X	X
If conducted in person, was childcare offered?												
Did public meeting notice include information about handicap accessibility support (e.g., support for participants with hearing or visual impairments, transportation for participants with physical disabilities, etc.)?						X						



Table 10-3. Procedural equity engagement checklist: Public comments and feedback.

“	Case Study											
	S. SF Bay		W. Sac.		S. Platte		SWCLA		HRE		HSGRR	
	Scoping	Report Draft	Scoping	Report Draft	Scoping	Report Draft	Scoping	Report Draft	Scoping	Report Draft	Scoping	Report Draft
Public Comments and Feedback												
Were there multiple ways for the public to communicate comments and feedback?	X	X	X	X		X	X	X		X	X	X
Was the public allowed to offer ideas and information about potential project effects (including EJ issues)?	X	X	X	X		X	X	X		X	X	X
Were there multiple avenues for publicly broadcasting comments and feedback?			X	X						X	X	X
Was the broadcasted information translated into multiple languages?												
Were comments adequately addressed (i.e., were comments either integrated into the analysis or respectfully rejected if deemed infeasible)?	X	X	X	X		X	X	X		X	X	X
Were comments incorporated into draft or final reports?	X	X	X	X			X	X		X	X	X
Were comments from individuals in underserved communities incorporated?												



10.2.2 Opportunities

Use more frequent, targeted engagement in locations informed by mapping impacted communities.

Geospatial tools can be used during the alternatives development process or when assessing tradeoffs to identify communities with potential impacts or benefits. Holding meetings or outreach activities in these areas can help to collect timely and relevant feedback for project planning. Additionally, if partners such as non-federal sponsors conduct engagement, these tools and processes can also be used to track partner engagement activities as well. Working collaboratively to reach impacted communities will be easier with stronger tools and processes to collate this information and track how it is used throughout a feasibility study.

Collect data, such as ZIP code, from participants and public commenters. While requirements such as the Paperwork Reduction Act limit full survey collection, asking for limited information such as a ZIP code would allow for an analysis of whether impacted populations are being reached through engagement. Tracking this information during a planning process could also allow for adaptive management of planned engagement, such as adding meetings or outreach activities in certain locations within a project's impact boundary to better reach nearby residents. Though it could be challenging to redirect resources within a given NEPA comment window, multiple comment periods or informal outreach outside of NEPA compliance could increase the effectiveness of public engagement. Additionally, accepting new forms of comments such as collecting photos and other forms of evidence that support input on project alternatives can enhance public comments and provide project team members with additional context for public concerns or support for alternatives.

Use coding software to aggregate and track comments throughout the planning process. The study team's use of MaxQDA software could be replicated throughout a planning process. The utility of more organized and aggregated technical comments is high; these comments could be used, for example, to streamline the process for development and revision of study appendices, to solicit feedback on tradeoffs between alternatives, to draw or revise impact or benefit boundaries, or to identify additional costs or benefits for quantification and analysis.

Formally track the impact of public comments on the final feasibility study report. Explicitly tracking instances where public comments contributed to edits in final reports could increase transparency with regards to use of public comments and has the potential to provide USACE project teams with the quantitative data needed to measure the success of engagement efforts throughout the project lifecycle and comply with Justice40. There are several opportunities to include this type of information in official project documentation (e.g., a separate column in the "response to public comments" tables, a separate appendix indicating where information from public comments was incorporated into final documents, in-text references, etc.).

Develop metrics that define 'meaningful' for engagement. To put these methods into practice, USACE may consider developing metrics that define what meaningful engagement is for this context. For example, USACE could consider setting a per-project target of engaging a certain percentage of residents living within the benefit or impact area. Additionally, establishing a means of tracking informal, non-NEPA engagement activities and dialogues with residents and local stakeholders would provide USACE with a more accurate accounting of who was engaged. This could include activities undertaken by both



USACE and project partners. This would allow project teams to better understand what percentage of the public was engaged throughout project planning. Another opportunity could connect to tracking and integration of public comments; for example, USACE could set a minimum threshold for the percentage of public comments that were integrated or public concerns/questions that were addressed in the final feasibility study report.

10.3. DISTRIBUTIONAL EQUITY ANALYSIS

10.3.1 Key Findings

In conducting the distributional equity analysis across the six case studies, the study team concluded that the scale of analysis matters. Census tracts, which are used by CEJST, are too large for this type of analysis, and the study team found that using the smallest geographic census units available—blocks for race, ethnicity, and poverty, and block groups for median household income (MHI) and per capita income—allowed a level of granularity in the analysis that most accurately represents the population characteristics of a designated area.

In mapping population characteristics for the areas identified for each case study analysis, the study team identified the value in applying a dasymetric mapping process to create population-weighted centroids, which linked population centers to blocks and block groups; allowing the study team to correct for edge effects by excluding any blocks or block groups on the periphery of a designated boundary where the most densely populated area fell outside the boundary.

Because the racial, ethnic, and economic characteristics of a place can vary greatly, even within a small, delineated area, the study team recognized that the use of odds ratios was key to assessing disproportionate impacts; as required by the EOs referenced in the Executive Orders and Agency Guidance section. Odds ratios provided a level of comparability across population characteristics that could have been otherwise inconsistent or misleading. The odds ratio approach not only reflects project benefits, but also existing conditions. This provides insight about the importance of clear decision-making around a study's reference area boundary. If you only use the county as a reference, you may identify equitable benefits, but many communities are inequitably distributed at the multi-county scale. The jurisdiction of the project's cost-share entity or a regional flood-prone population could also be considered when USACE begins to set parameters for this type of guidance. It is also important to consider that odds ratios are a great tool for differentiating project effects at the county-level or even regionally, but large-scale reporting of project impacts at the national level would require more robust analysis to draw comparisons between projects in different parts of the country.

Finally, the study team determined that the delineation of buffers to determine a potential benefit or impact area (how it happens, the time in which it happens, and who is involved) will significantly impact the outcome of any analysis. Though there are many cases in which project authorization is tied to a specific benefit area with rigid boundaries (e.g. the West Sacramento study area boundary used as the modeling domain for the damage analysis which is located inside a complex levee system), but there are instances where expanding or shifting a project boundary could result in a significant shift in the populations experiencing potential project benefits. Delineating these boundaries using scientifically sound processes is important not just for a clear accounting of benefits, but also for avoiding potential



litigation; as noted in the case law review in the Case Law Review, decisions such as determining impacted communities can be challenged for being "arbitrary and capricious." (*Vecinos para el Bienestar de la Comunidad Costera v Federal Energy Regulatory Commission*, 2021)"

10.3.2 Opportunities

Where feasible, conduct exploratory distributional equity analyses when developing impact and benefit area boundaries throughout a project's lifecycle. Conducting distributional analysis for a project boundary before public engagement begins could allow USACE project teams better understand the population characteristics that would potentially benefit from or be impacted by a proposed project within a given boundary, and thus allow project teams to iterate on, move, or expand these boundaries to support a more equitable distribution of benefits at the onset of a project.

Use outputs from distributional equity analyses to support procedural engagement methods.

Outcomes and outputs from distributional analyses can inform procedural methods and plans. A more acute understanding of where potentially benefiting or impacted populations are located can help USACE project teams improve reach and solicit more relevant feedback. A more detailed understanding of population characteristics within a project boundary can support decisions about engagement methods such as the need for translated materials or the types of venues that might facilitate robust, local participation in public meetings and engagements.

Explore the use of distributional equity analysis outputs as a communication tool for the public.

Outputs from distributional equity analysis can serve as multi-purpose tools throughout a project's lifecycle. In addition to providing a set of visuals to aid project teams in making decisions about project boundary development or engagement methods, the information produced from dasymetric mapping processes and generating population-weighted centroids can be used to communicate population characteristics, including density, at the smallest units possible (i.e., census block and block group) with the general public and other project stakeholders. Presenting this type of information clearly and visually can provide the public with a better understanding of how and why alternatives might be considered, or decisions might be made to prioritize a more equitable distribution of benefits.

10.4. BENEFIT COST ANALYSIS WITH EQUITY WEIGHTING

10.4.1 Key Findings

In conducting retrospective BCAs, the study team tested several different methods of allocating benefits and weighting using different reference incomes. The efficacy of this equity weighting method depends entirely on the choice of reference income, as noted in the case study results. Because the weights are a mathematical function between the study area and the reference income, the analyst's or decisionmaker's priorities and judgement determine the results of the weighting exercise by setting the relationship between the study area and the reference income. For example, a decisionmaker could prioritize equity weighting of benefits within a particular geography, such as a state; this would normalize differences between states and emphasize differences in income within a state. This also highlights a difficulty in setting these weights at a national level. A US median income used as a reference income helps to normalize across housing value disparities, but cannot measure other important factors, such as disparities in housing quality or other factors that might be important for FRM projects. Exploring and



understanding these tradeoffs in the context of USACE Civil Works priorities will be key for standardizing the use of equity weighting methods.

While the study team only weighted for income, the method would work for other disparities as well, if the data were available. For example, while the draft update of Circular A-4 was undergoing peer review, some commenters noted that income weighting would not necessarily capture key measures or indicators of wellbeing, such as household wealth (Joskow et al., 2023). The limitation is data availability; wealth is more difficult to measure, being a ‘stock’ rather than a ‘flow’ as captured by Census surveys. Weighting a disparity like wealth could matter a great deal in a Civil Works context; reductions in flood risk from structural improvements like levees might be more important to a community without wealth (resources to recover) than a community with higher savings levels.

Additionally, the benefit allocation methods tested in these case studies were used because of limitations in available data. For FRM projects, the outputs from consequence modeling of damage reductions can be used directly if they correspond to the geographies of analysis (e.g., block groups). The study team did not have access to these outputs and thus allocated the benefits using methods like structure count and structure value. Throughout a project study period, using spatial tools and tracking data like FRM benefits allocated by census block group can inform BCA development and benefit accounting.

Finally, the study team found that the choice of discount rate remains a significant factor in BCA even with equity weighted benefits. Unsurprisingly, a lower discount rate increases the value of future benefits, and correspondingly increases BCRs. This also impacts intergenerational equity by increasing the benefits accruing to future generations, and highlights how the choice of discount rate impacts assessments of benefits across time, whereas other distributional analyses assess benefits across space or populations. While USACE does not use the OMB’s rate in Circular A-4 (OMB, 2023a) for assessing water resources projects, the equity implications of a lower discount rate are important to understand for project prioritization and other decision-making criteria. Because project benefits are often calculated based in part on housing values, some projects will not meet a BCR threshold in a low-income area or an area with low housing values. With a lower discount rate, those projects may be feasible, as longer-term benefits can be valued higher in present value terms. However, projects in high income or high value areas will have BCRs that are even higher, so they will also appear better with a lower discount rate. A pure mathematical ranking of BCRs that does not take these differences into account will miss the equity implication of a lower discount rate.

10.4.2 Opportunities

Equity weighting offers an opportunity to explore larger questions of equity priorities within the Civil Works program. Because these benefit weighting methods can be used in many different ways, with many options for what to use as a reference, the structure and use of these methods is dependent on decision maker judgement and priorities. Understanding what is important to account for within the Civil Works program will necessarily guide the structure, use, and procedures for equity weighting of benefits for USACE projects. Including sensitivity analyses of different reference populations in most BCAs could also be a helpful tool in achieving a more equitable distribution of benefits.

The use of equity weighting could improve the accounting of benefits throughout a project’s lifecycle. Benefits accounting, including equity weighting, can be done earlier in a project’s lifecycle. For



example, exploratory accounting of benefits for different alternatives or using different benefit or impact areas can help assess the tradeoffs between alternatives. This information could even be presented publicly in conjunction with the other procedural and distributional equity opportunities outlined in this chapter, offering the public the opportunity to delineate additional benefits or impacts.

Equity weighting could support benefits accounting for programs like Justice40. The Justice40 initiative requires 40% of the benefits of covered programs to flow to disadvantaged communities. If USACE were to consider using equity weighted BCAs, the weighted benefits to these communities (and subsequently discounted benefits to high income communities) could support how USACE accounts for and reports benefits for this initiative. However, this may require a more extensive retrospective analysis of projects.

10.5. CONSIDERATIONS FOR IMPLEMENTATION

Updated federal guidance provides USACE project teams with greater opportunities to consider more equitable distribution for Civil Works projects, but it also increases the complexity of decision making. In assessing how procedural, distributional, and equity-weighted BCAs could be implemented across different contexts (districts, business lines, individual projects, etc.), it can be useful to evaluate how various pre-project decisions need to be supported by one or more of these types of analyses. Developing and articulating the decision structure—informed by USACE goals—can inform which types and levels of analyses will support a more equitable distribution of benefits more broadly. Considerations may include the level of analysis for which the methods outlined in this report could be used, goal setting around individual projects versus entire portfolios, or whether these methods could be used to compare competing projects. These methods might also help project teams measure progress towards specifically identified targets.

In planning for integrating different components of the methods outlined in this report, there will also be key tradeoffs to consider. There are many ways to execute, sequence, aggregate, and use the results presented in the methodologies applied throughout the six case studies referenced in this document. Considering the multitude of possibilities associated with these methods and results can support USACE in building a process to guide project teams across diverse contexts. Because the application of these methods is fluid, there are some potential workflow opportunities for USACE to consider. Some methods or components of methods might be used at different phases throughout the project lifecycle, but prioritizing the decision context is especially important. It may also be valuable to consider how these methods could be integrated into USACE planning processes through a phased approach; with an emphasis on prioritizing what is most important in the short term, and contemplating which pieces of different methods can be refined before wide scale implementation.

Finally, complex decisions will require investment in resources that will support the skill development and time needed to understand, plan for, and implement these methods. It will also be critical that decision-makers are trained to interpret complex analyses and outcomes. Pending IRB and PRA considerations, data collection and organization to support the application of these methods will be critical, and the skillsets that support quality GIS analysis, data science, communications, and graphic design are also important pieces to account for in the pursuit of more robust equity analyses that support a more fair distribution of benefits within USACE projects.



11.0 CONCLUSION

With the introduction of recent executive actions, including EO 14008 and 14096 that have required expansion on established environmental justice methodologies, federal agencies and departments are now exploring how to more effectively consider not only the disproportionality of adverse impacts, but also the distribution of benefits from federal projects and programs. As the government's largest water resources development and management agency, USACE's Environmental and Civil Works missions are an ideal place to consider the equitable distribution of benefits at multiple scales.

USACE has many planning tools and guidance documents to consider, including their own draft Agency Specific Procedures for implementing the PR&G. Additionally, new OMB guidance, such as Circular A-4, which provides guidance for regulatory analysis, and Circular A-94, which provides guidance for benefit-cost analysis for federal programs, include changes to analytical methods for agencies to use as guidance in assessing the distribution of benefits to disadvantaged communities. These changes in methodology and approach, which expand upon the traditional BCA process, can significantly impact which projects are built based on how benefits are quantified. The case study analysis in this report tested some of these newer methods and approaches for assessing expanded dimensions of equity.

Applying a distributional equity analysis across six contexts to examine the potential distribution of benefits or disproportionate impacts, the study team delineated the affected environment, identified and interpolated the affected populations, and conducted geostatistical analysis to evaluate these potential impacts. The procedural equity analysis considered stakeholder engagement and reviewed public comments to determine the extent to which communities impacted by USACE's proposed projects and plans were meaningfully engaged throughout plan development, and the study team performed a BCA with equity weighting. This involved inflating the monetary value of benefits to those who earn or have less than a reference income and shrinking the value of benefits to those who earn or have more than that same reference income to better reflect the actual impact of a project on the wellbeing of the people anticipated to benefit from it. In applying EJ research methodologies and frameworks to re-analyze the potential disproportionate impacts and equity-weighted benefits of a range of USACE public works projects, the study team identified that the methods used to assess the potential impacts and benefits of each project are context-dependent, based on the specific goals and planned activities of each individual project. These methods can be applied in different ways to answer different questions at multiple scales, from project, to division, district, or headquarters.

Aside from statutory requirements, USACE has significant flexibility in how its own planning processes fulfill the various EJ requirements outlined in recent guidance to consider equitable distribution of benefits. The methods and tradeoffs demonstrated in this report can frame the opportunities and decisions USACE may consider while aligning their processes to newer guidance and rulemaking.



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APPENDICES



APPENDIX A.



A.1 SOUTH SAN FRANCISCO BAY

A.1.1 Demographics

Table A-1. South San Francisco Bay demographics: FRR benefit area (Manson et al., 2023).

Category	Located Inside Flood Risk Reduction Benefit Area		Located Outside Flood Risk Reduction Benefit Area		Reference Area Total	% of Total Reference Area Population
	Count	%	Count	%		
White	6,791	23.1%	615,813	32.3%	622,604	32.2%
Black	823	2.8%	44,137	2.3%	44,960	2.3%
Native American ¹⁹	262	0.9%	21,871	1.1%	22,133	1.1%
Asian	16,653	56.6%	742,349	38.9%	759,002	39.2%
Hawaiian	150	0.5%	6,754	0.4%	6,904	0.4%
Other	2,605	8.8%	268,510	14.1%	271,115	14.0%
Two Races	2,157	7.3%	207,283	10.9%	209,440	10.8%
Total	29,441		1,906,717		1,936,158	
Hispanic	4,808	16.3%	482,500	25.3%	487,308	25.2%

Table A-2. South San Francisco Bay demographics: construction impact area (Manson et al., 2023).

Category	Located in Construction Impact Area		Located Outside Construction Impact Area		Reference Area Total	% of Total Reference Area Population
	Count	%	Count	%		
White	1,225	14.8%	621,379	32.2%	622,604	32.2%
Black	129	1.6%	44,831	2.3%	44,960	2.3%
Native American	77	0.9%	22,056	1.1%	22,133	1.1%
Asian	5,194	62.9%	753,808	39.1%	759,002	39.2%
Hawaiian	45	0.5%	6,859	0.4%	6,904	0.4%
Other	949	11.5%	270,166	14.0%	271,115	14.0%
Two Races	633	7.7%	208,807	10.8%	209,440	10.8%
Total	8,252		1,927,906		1,936,158	
Hispanic	1,600	19.4%	485,708	25.2%	487,308	25.2%

¹⁹ Note: Indigenous American is often the term that many native people prefer, but because the US Census uses “Native American,” the research team used this term to maintain consistency and eliminate any confusion.



A.1.2 Locations of Underserved Communities (Both Analysis Benefit and Impact Areas)

Figure A-1 through Figure A-7 demonstrate locations throughout Santa Clara County (the reference area) and the two impact areas (the FRR benefit area and the construction impact area) where concentrations of different racial and ethnic groups are average, above average, and significantly above average. These maps reference racial and ethnic groups that are more likely to live within each area (even when only slightly more likely).

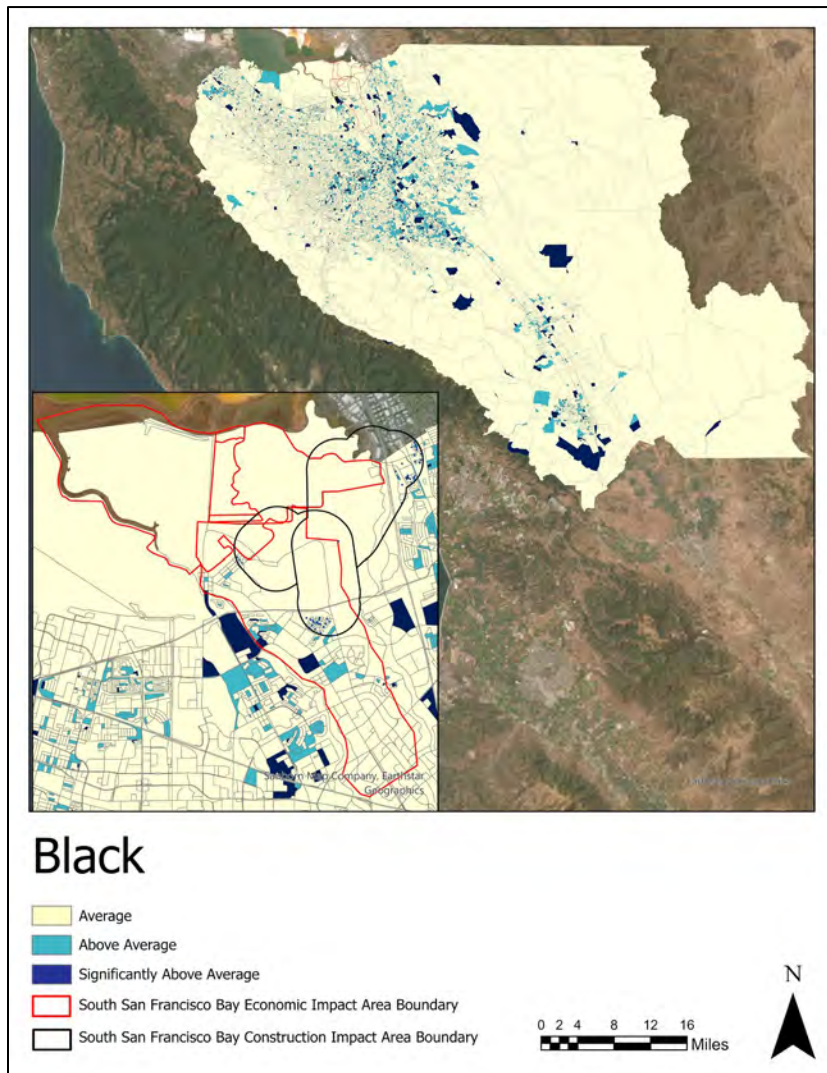


Figure A-1. Proportion of Black residents inside and outside reanalysis area boundaries.

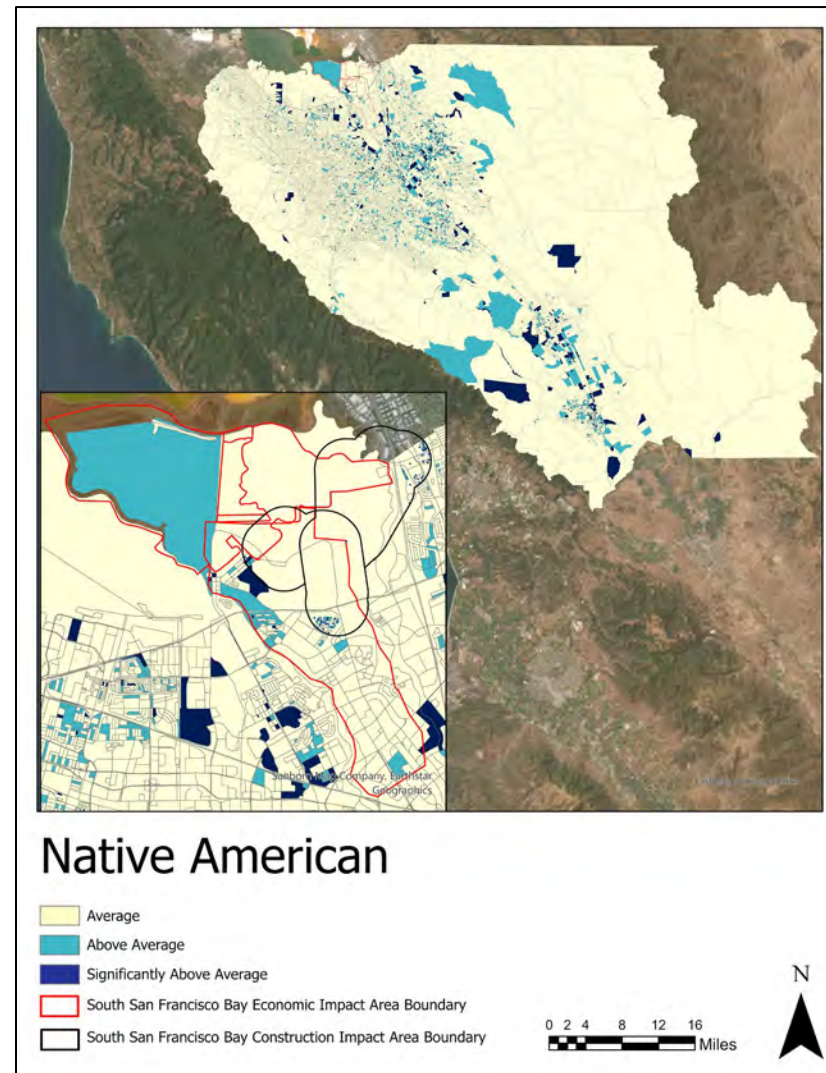


Figure A-2. Proportion of Native American residents inside and outside reanalysis area boundaries.

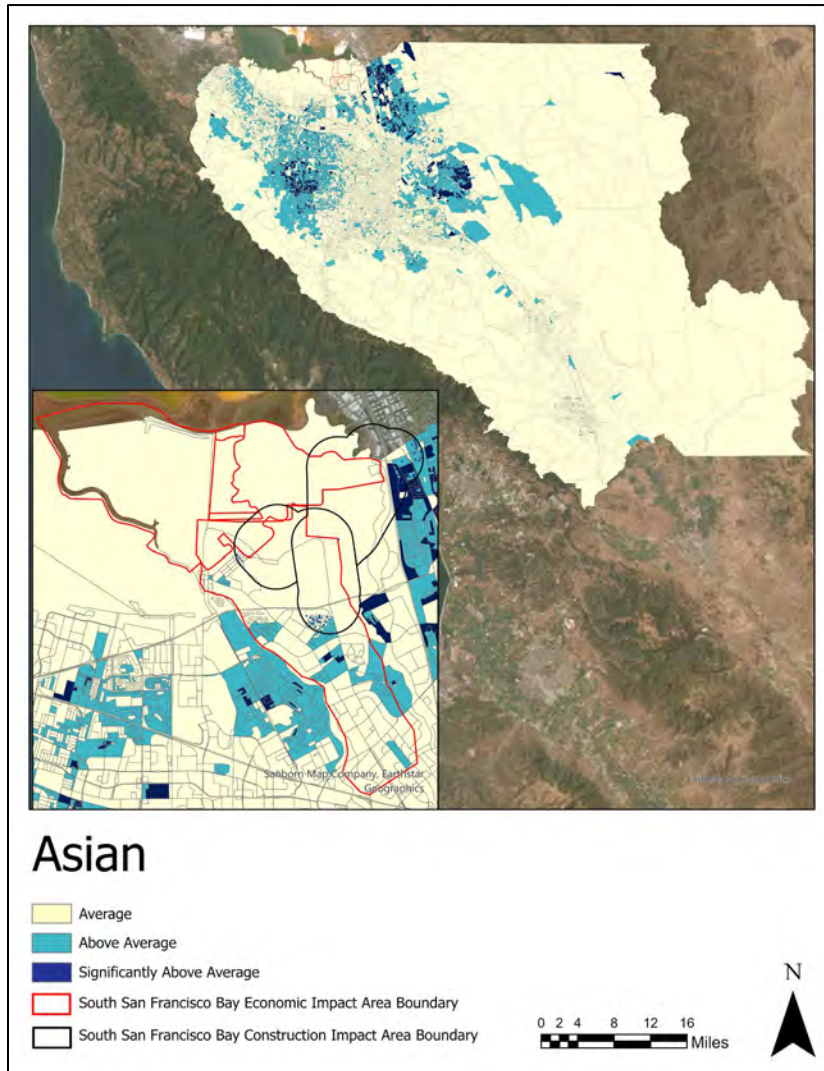


Figure A-3. Proportion of Asian residents inside and outside reanalysis area boundaries.

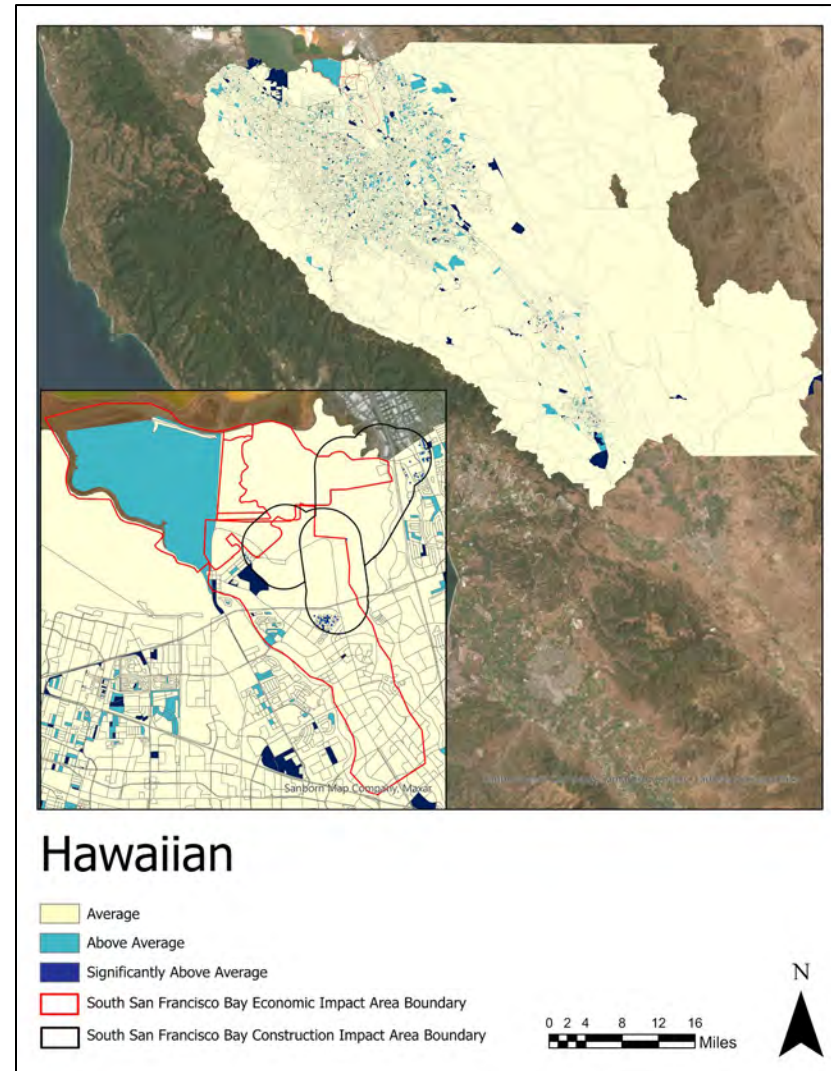


Figure A-4. Proportion of Hawaiian residents inside and outside reanalysis area boundaries.

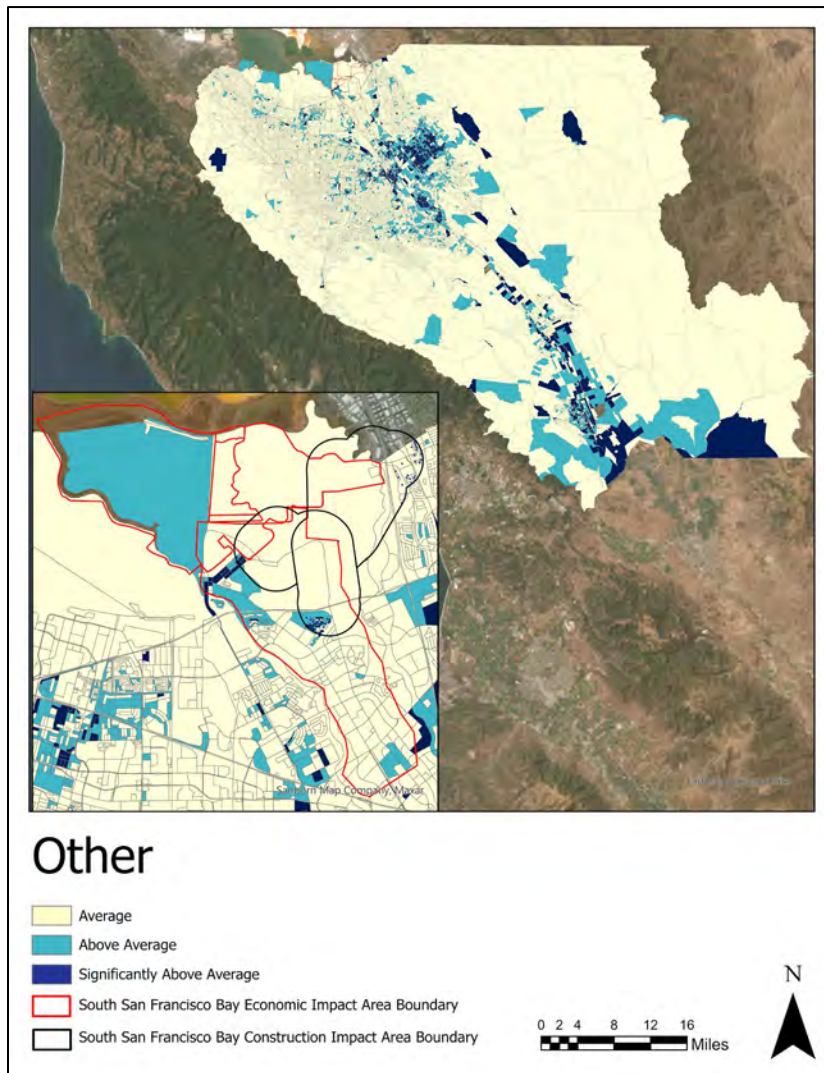


Figure A-5. Proportion of Other residents inside and outside reanalysis area boundaries.

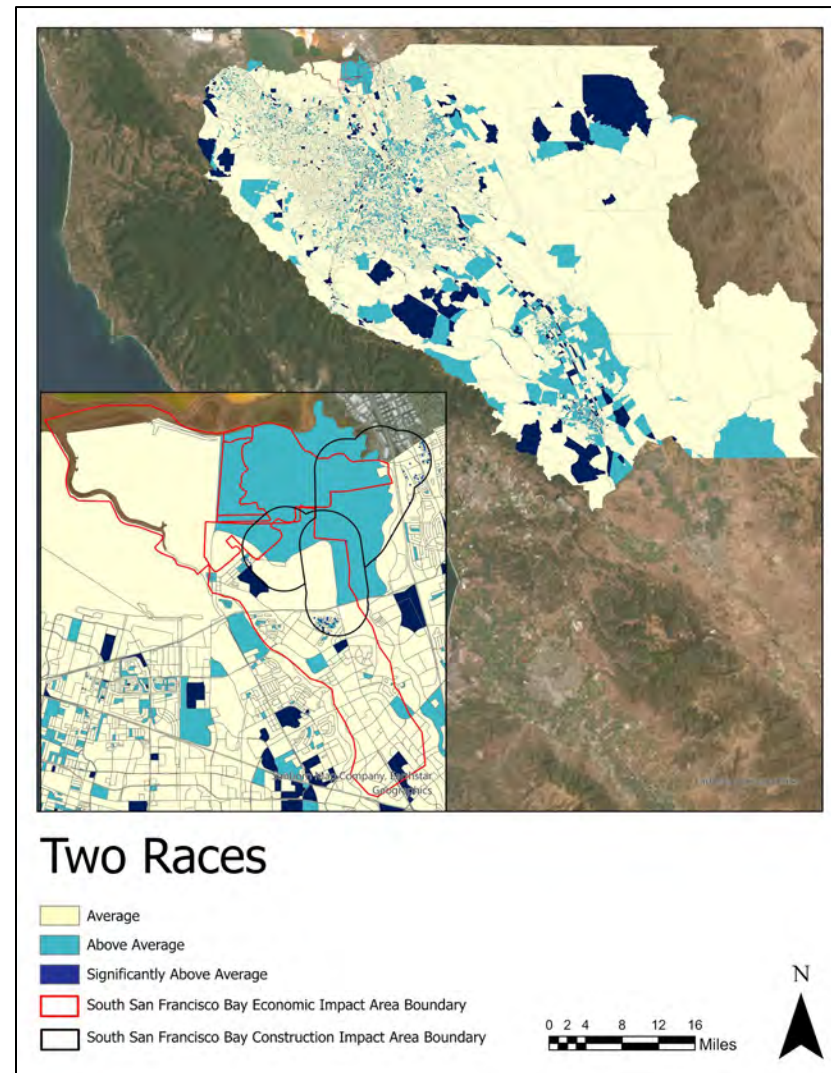


Figure A-6. Proportion of residents identifying as Two Races inside and outside reanalysis area boundaries.

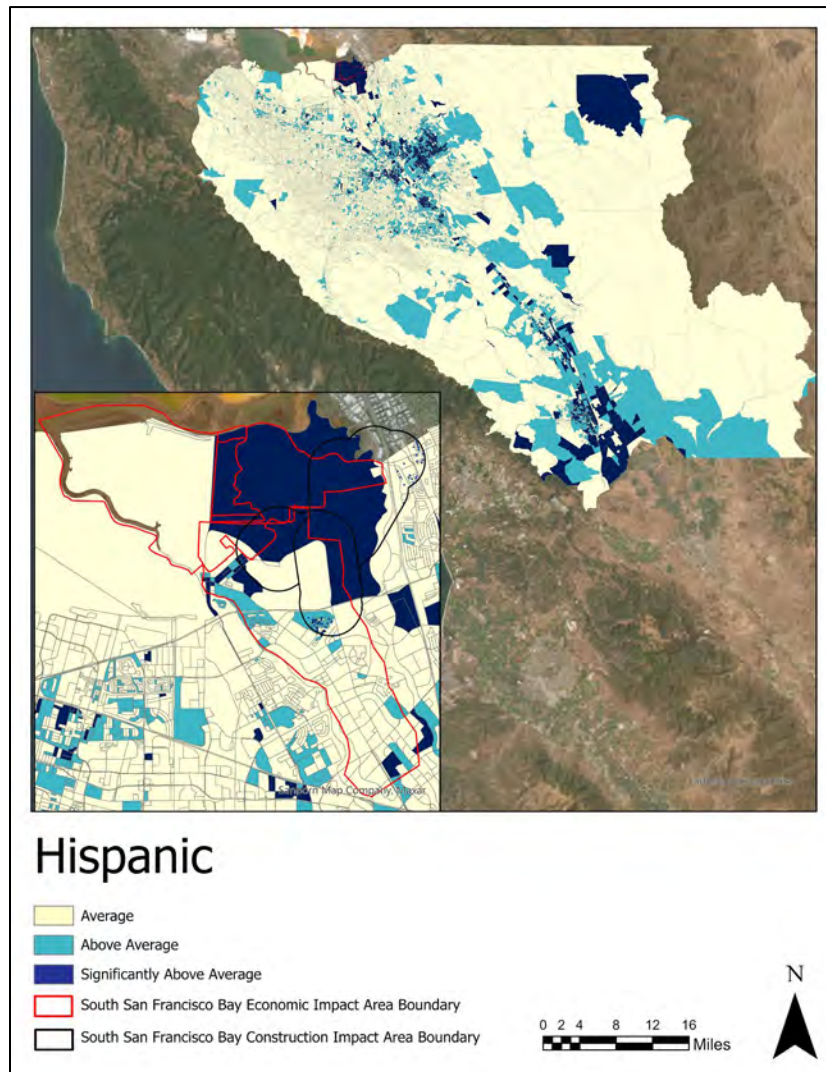


Figure A-7. Proportion of Hispanic residents inside and outside reanalysis area boundaries.



A.1.3 Weighted Benefits

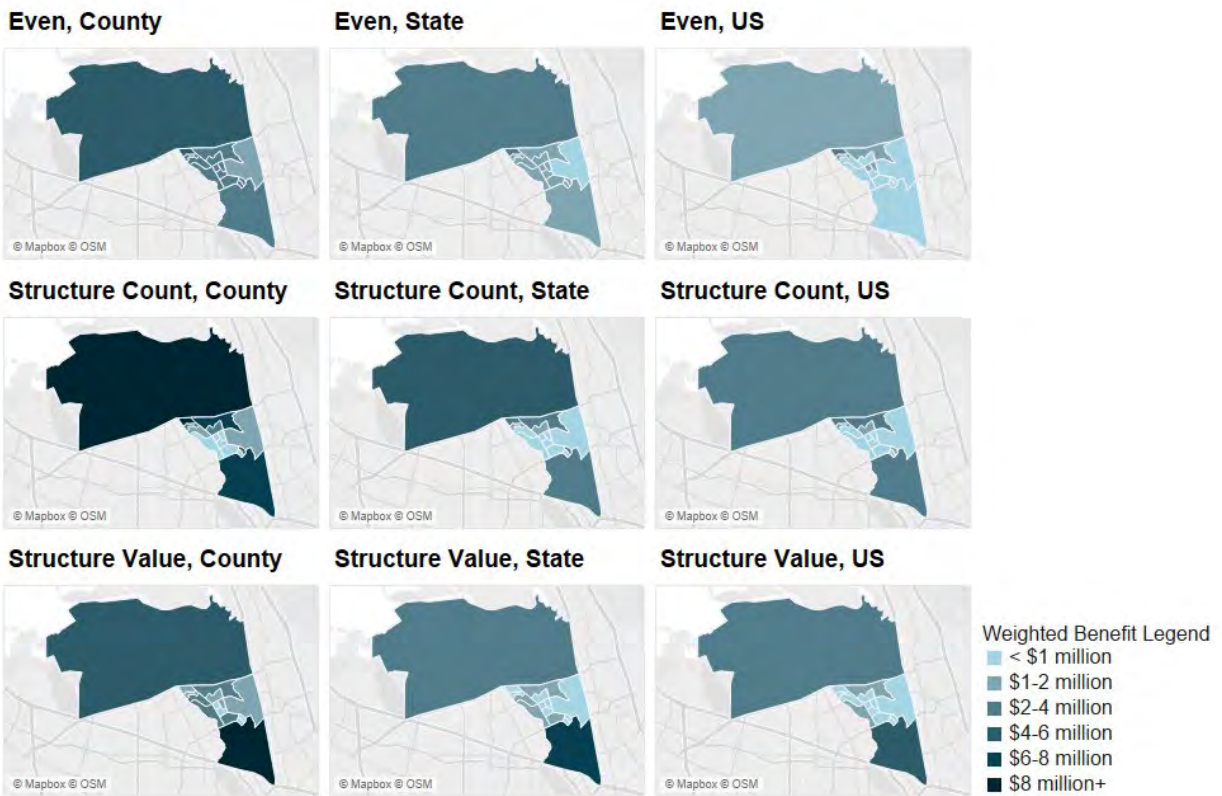


Figure A-8. Weighted benefit by allocation approach and comparison baseline.



A.2 WEST SACRAMENTO

A.2.1 Demographics

Table A-3. West Sacramento demographics: FRR benefit area (Manson et al., 2023).

Category	Located in Flood Risk Reduction Benefit Area		Located Outside Flood Risk Reduction Benefit Area		Reference Area Total	% of Total Reference Area Population
	Count	%	Count	%		
White	25,483	47.2%	81,821	50.4%	107,304	49.6%
Black	2,675	5%	3,489	2.1%	6,164	2.8%
Native American	949	1.8%	2,417	1.5%	3,366	1.6%
Asian	7,352	13.6%	23,040	14.2%	30,392	14%
Hawaiian	625	1.2%	554	0.3%	1,179	0.5%
Other	7,892	14.6%	25,995	16%	33,887	15.7%
Two Races	8,965	16.6%	25,146	15.5%	34,111	15.8%
Total	53,941		162,462		216,403	
Hispanic	17,276	32%	54,424	33.5%	71,700	33.1%

A.2.2 Locations of Underserved Communities

Figure A-9 through Figure A-12 demonstrate locations throughout Yolo County (the reference area) and West Sacramento (the impact area) where concentrations of different racial and ethnic groups are average, above average, and significantly above average. These maps reference racial and ethnic groups that are more likely to live within the impact area (even when only slightly more likely).

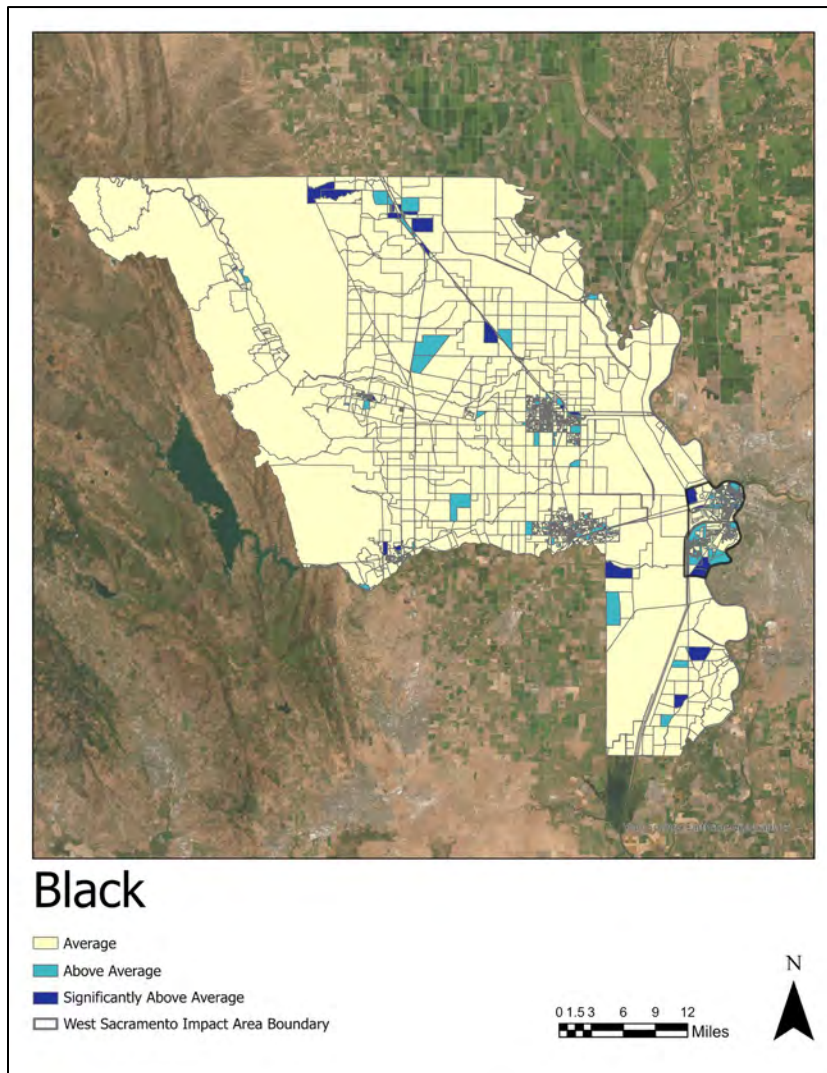


Figure A-9. Proportion of Black residents inside and outside reanalysis area boundaries.

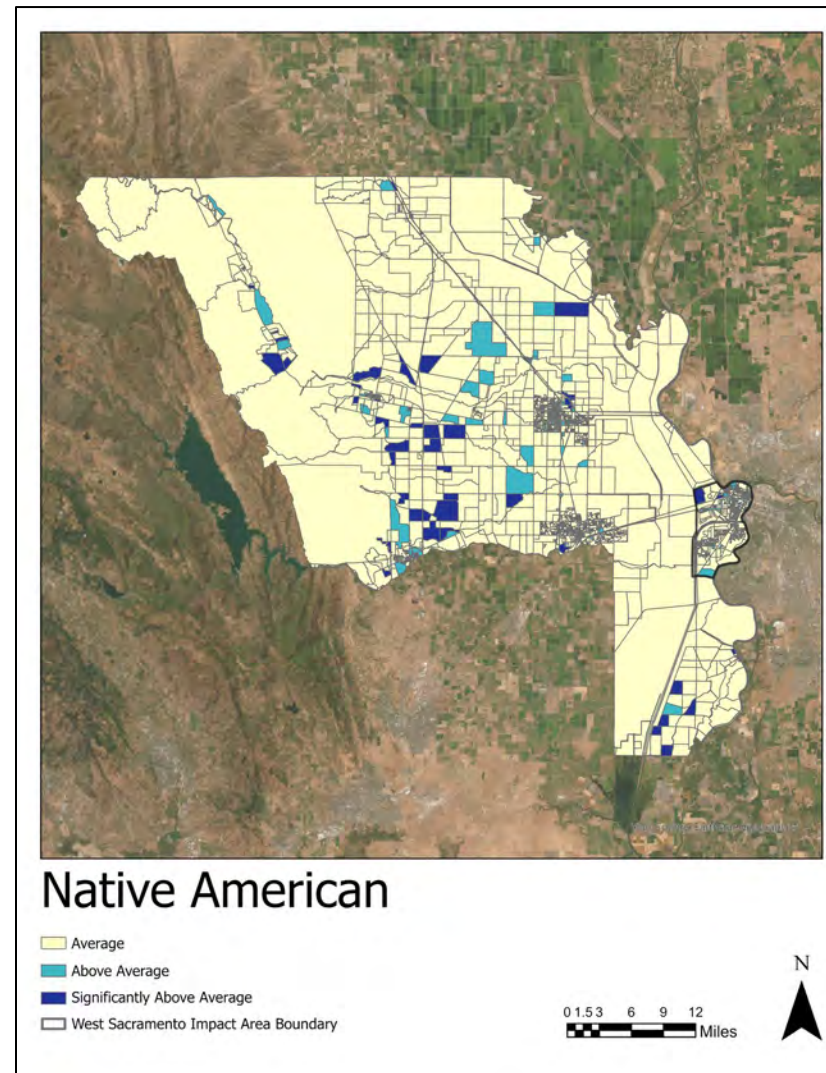


Figure A-10. Proportion of Native American residents inside and outside reanalysis area boundaries.

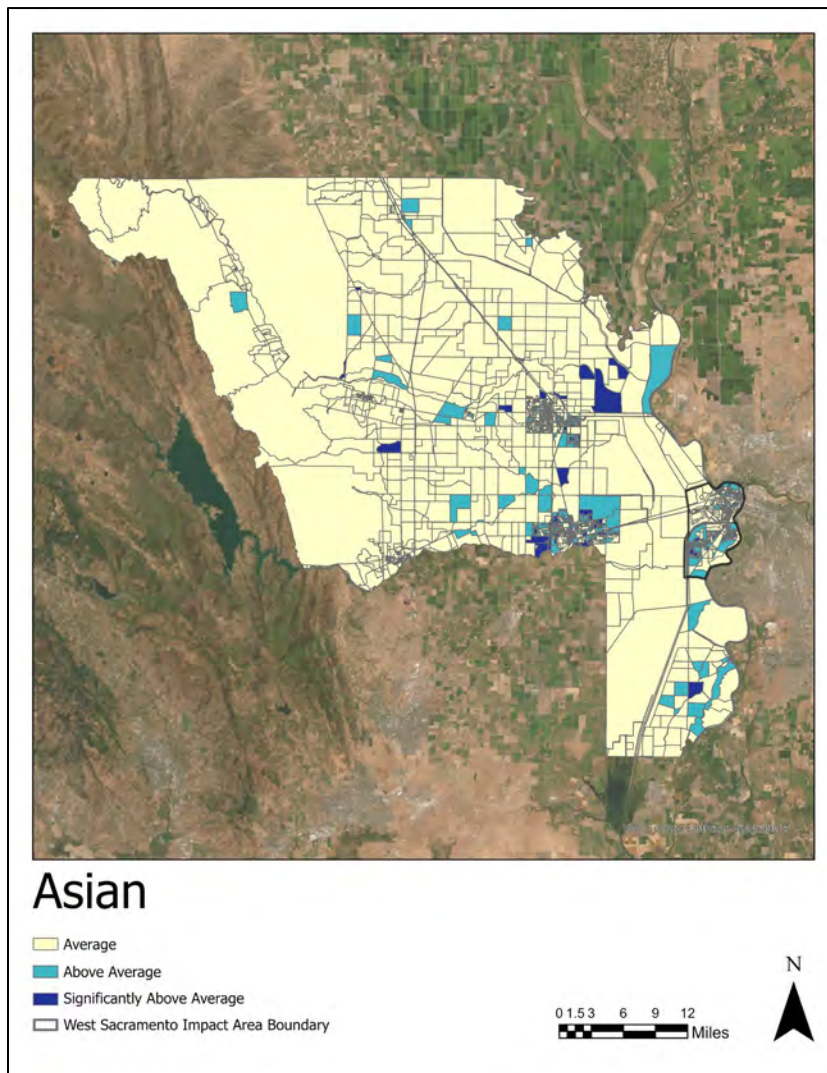


Figure A 11. Proportion of Asian residents inside and outside reanalysis area boundaries.

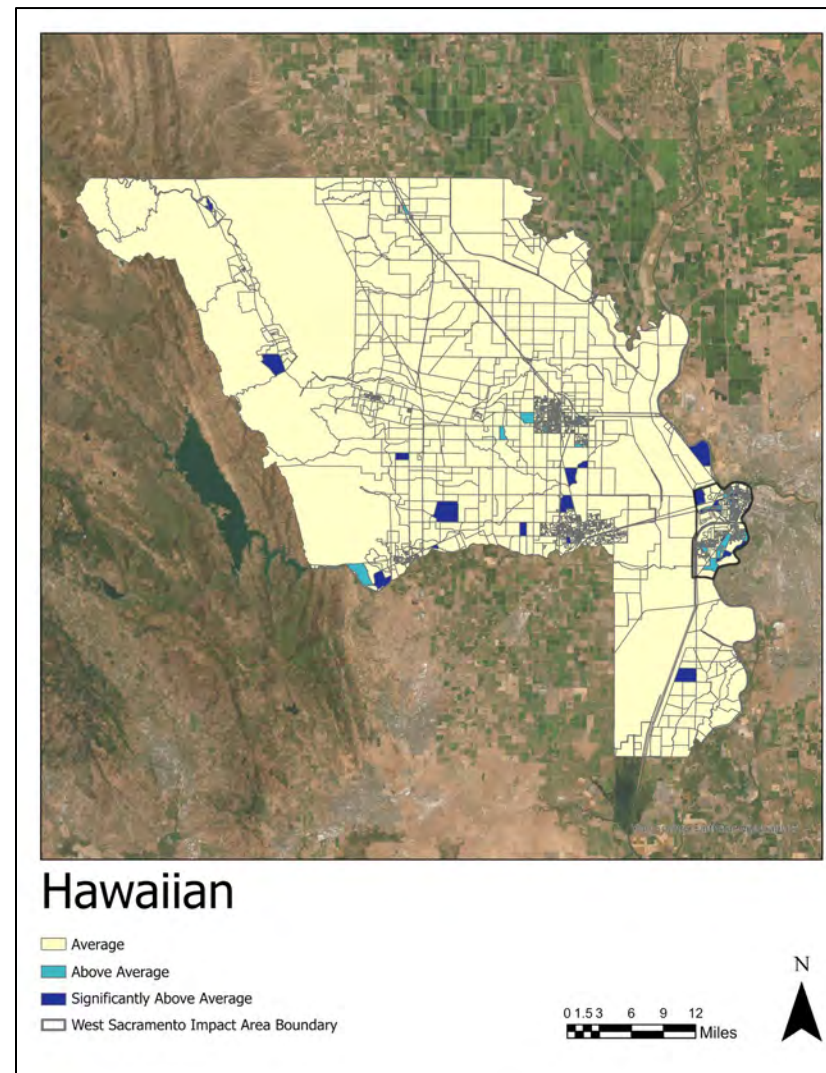


Figure A-11. Proportion of Hawaiian residents inside and outside reanalysis area boundaries.

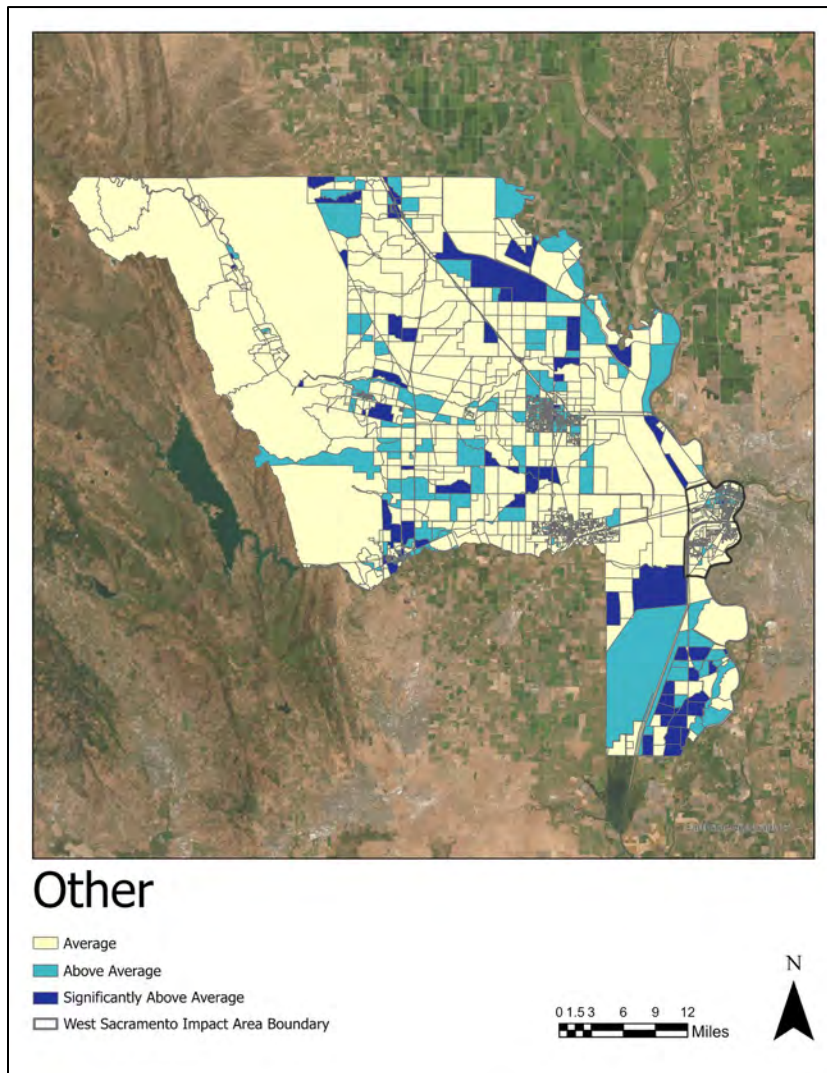


Figure A 13. Proportion of Other residents inside and outside reanalysis area boundaries.

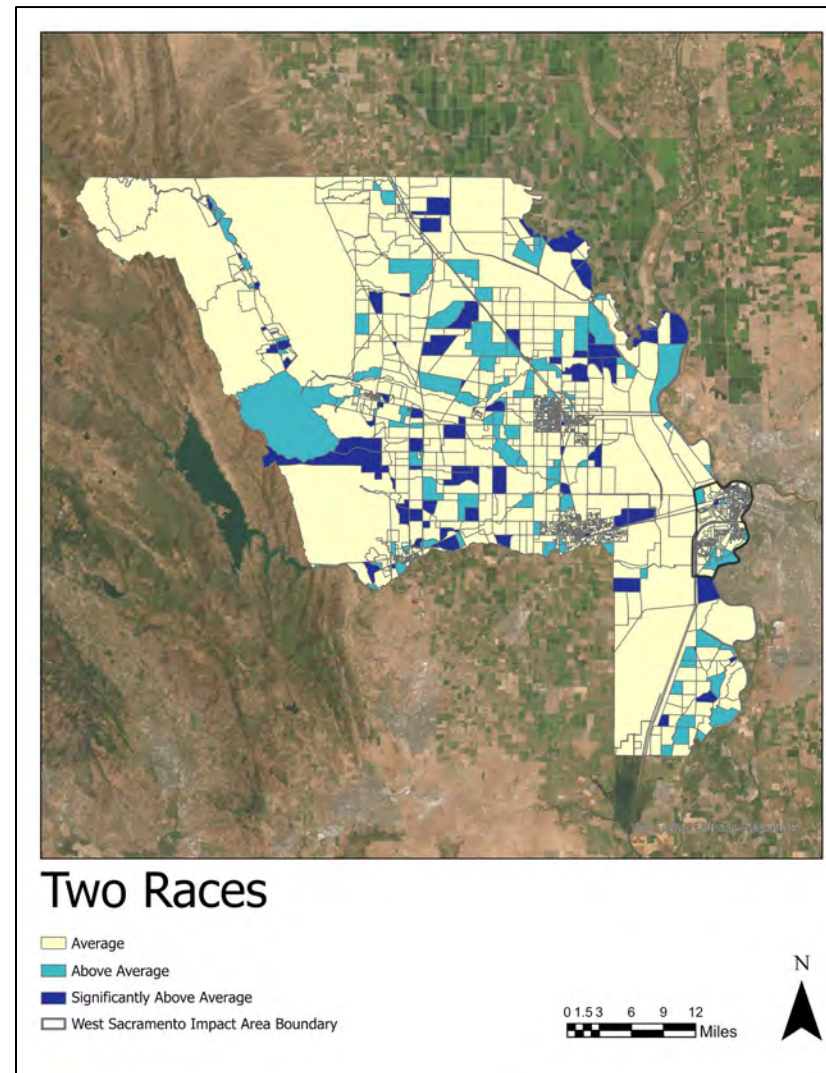


Figure A 14. Proportion of residents identifying as Two Races inside and outside reanalysis area boundaries.

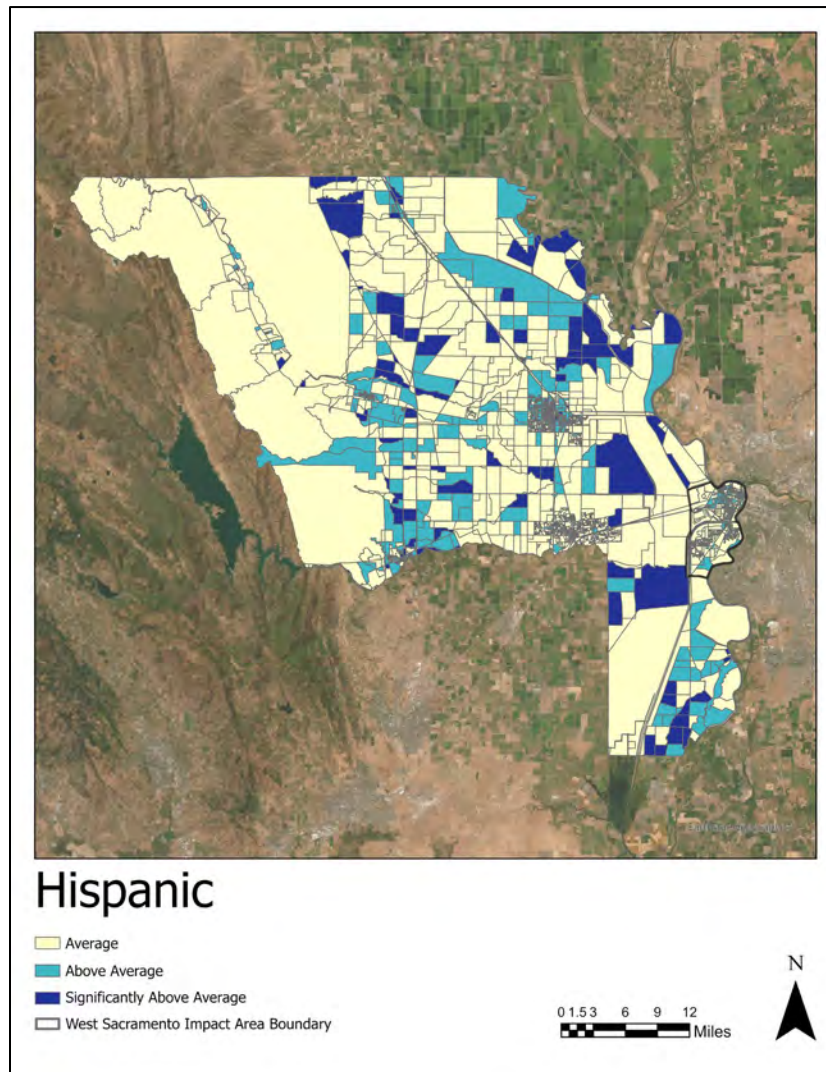


Figure A 15. Proportion of Hispanic residents inside and outside reanalysis area boundaries.



A.2.3 Weighted Benefits

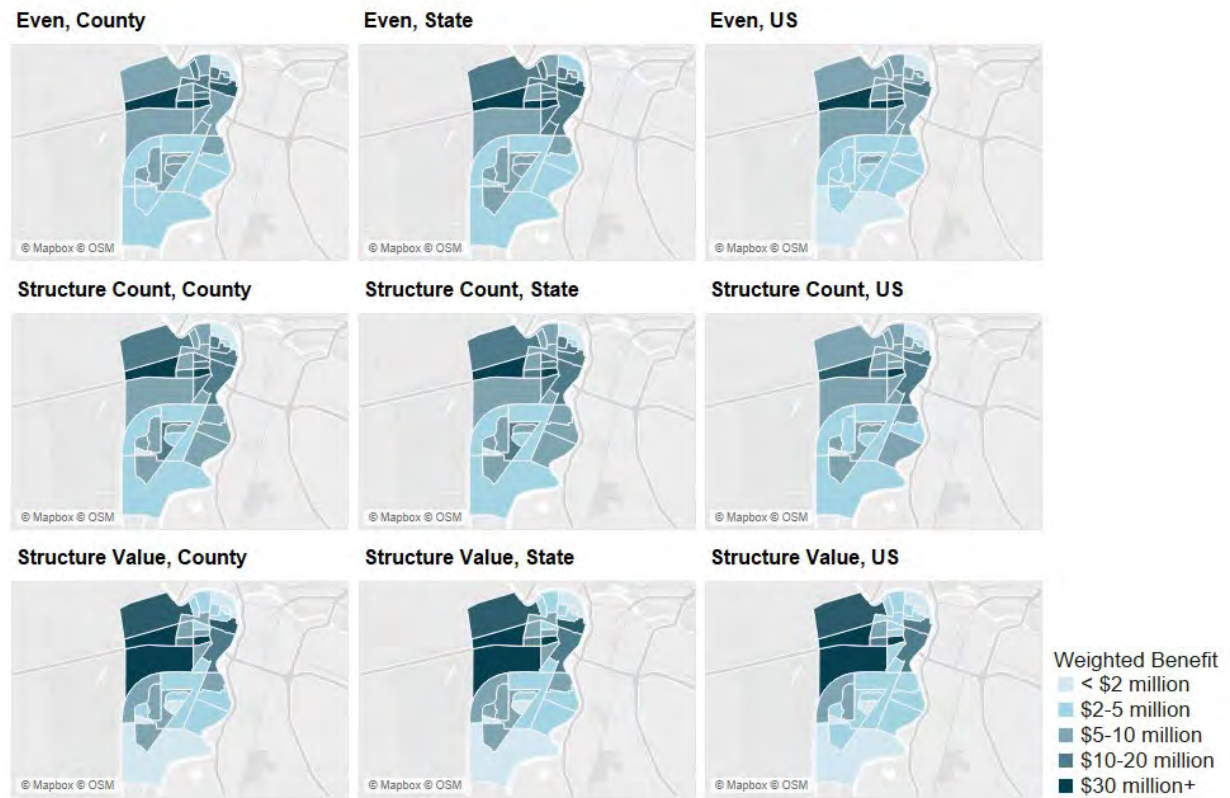


Figure A-12. Weighted benefit by allocation approach and comparison baseline.



A.3 SOUTH PLATTE RIVER & TRIBUTARIES

A.3.1 Demographics

Table A-4. South Platte demographics: recreation access benefit area (Manson et al., 2023).

Category	Located in Recreation Access Benefit Area		Located Outside Recreation Access Benefit Area		Reference Area Total	% of Total Reference Area Population
	Count	%	Count	%		
White	19,153	75.6%	439,773	60.1%	458,926	60.6%
Black	1,071	4.2%	66,709	9.1%	67,780	9%
Native American	271	1.1%	10,948	1.5%	11,219	1.5%
Asian	833	3.3%	28,999	4%	29,832	3.9%
Hawaiian	20	0.1%	1,584	0.2%	1,604	0.2%
Other	1,526	6%	83,903	11.5%	85,429	11.3%
Two Races	2,477	9.8%	99,879	13.6%	102,356	13.5%
Total	25,351		731,795		757,146	
Hispanic	4,261	16.8%	206,516	28.2%	210,777	27.8%

Table A-5. South Platte demographics: FRR benefit area (Manson et al., 2023).

Category	Located in Flood Risk Reduction Benefit Area		Located Outside Flood Risk Reduction Benefit Area		Reference Area Total	% of Total Reference Area Population
	Count	%	Count	%		
White	26,342	80.7%	432,584	59.7%	458,926	60.6%
Black	859	2.6%	66,921	9.2%	67,780	9%
Native American	188	0.6%	11,031	1.5%	11,219	1.5%
Asian	1,376	4.2%	28,456	3.9%	29,832	3.9%
Hawaiian	21	0.1%	1,583	0.2%	1,604	0.2%
Other	887	2.7%	84,542	11.7%	85,429	11.3%
Two Races	2,981	9.1%	99,375	13.7%	102,356	13.5%
Total	32,654		724,492		757,146	
Hispanic	3,233	9.9%	207,544	28.6%	210,777	27.8%

A.3.2 Locations of Underserved Communities

Figure A-13 through Figure A-19 below demonstrate locations throughout Denver County (the reference area) and Harvard Gulch (one of the impact areas) where concentrations of different racial and ethnic groups are average, above average, and significantly above average. These maps reference racial and ethnic groups that are more likely to live within the Harvard Gulch impact area (even when only slightly more likely).

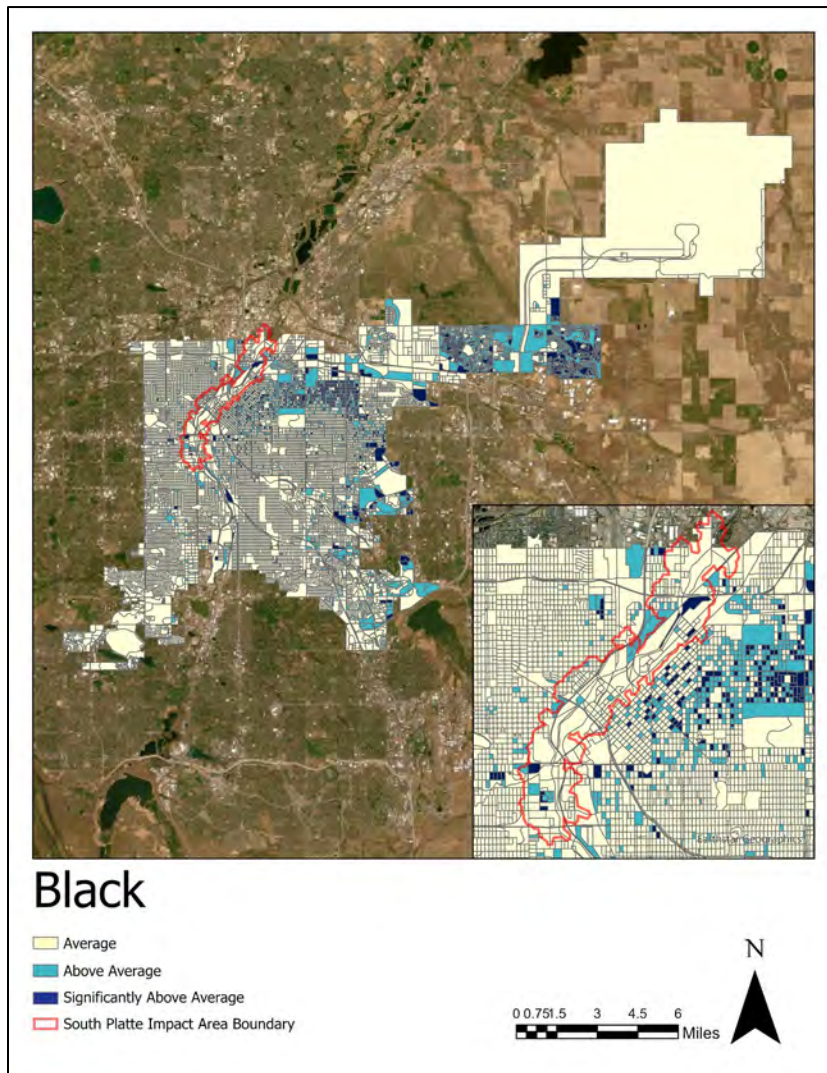


Figure A-13. Proportion of Black residents inside and outside reanalysis area boundaries.

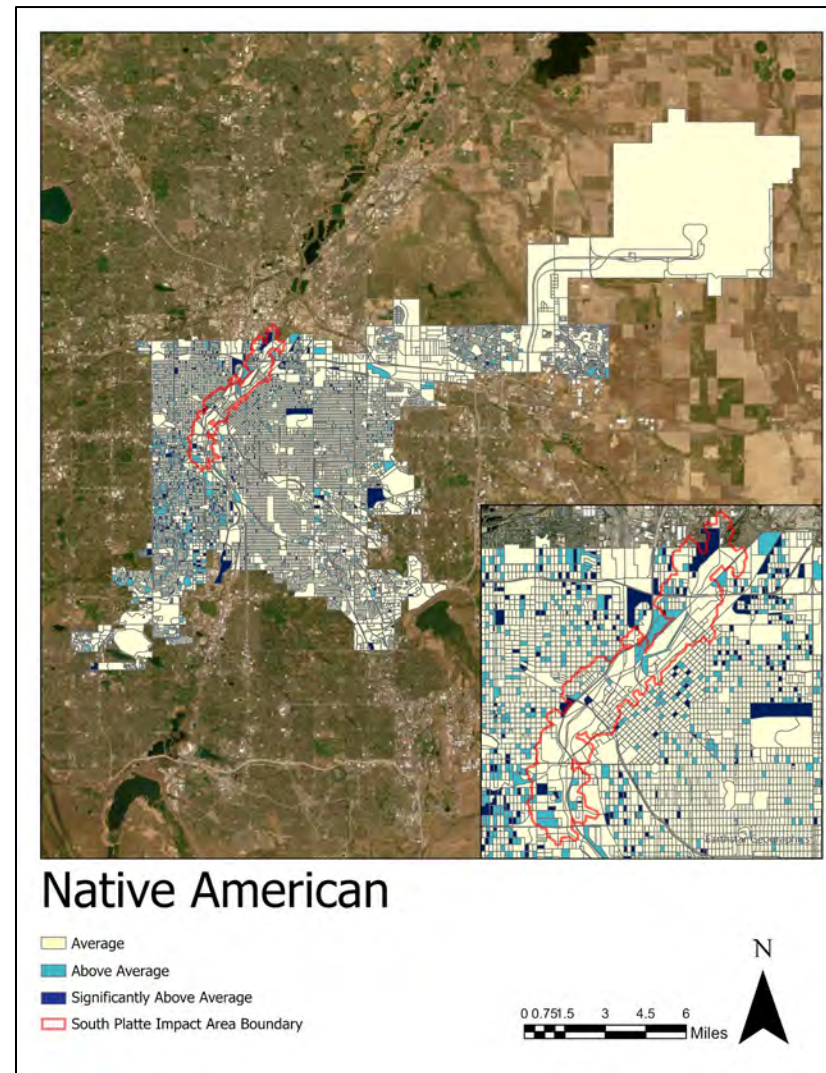


Figure A-14. Proportion of Native American residents inside and outside reanalysis area boundaries.

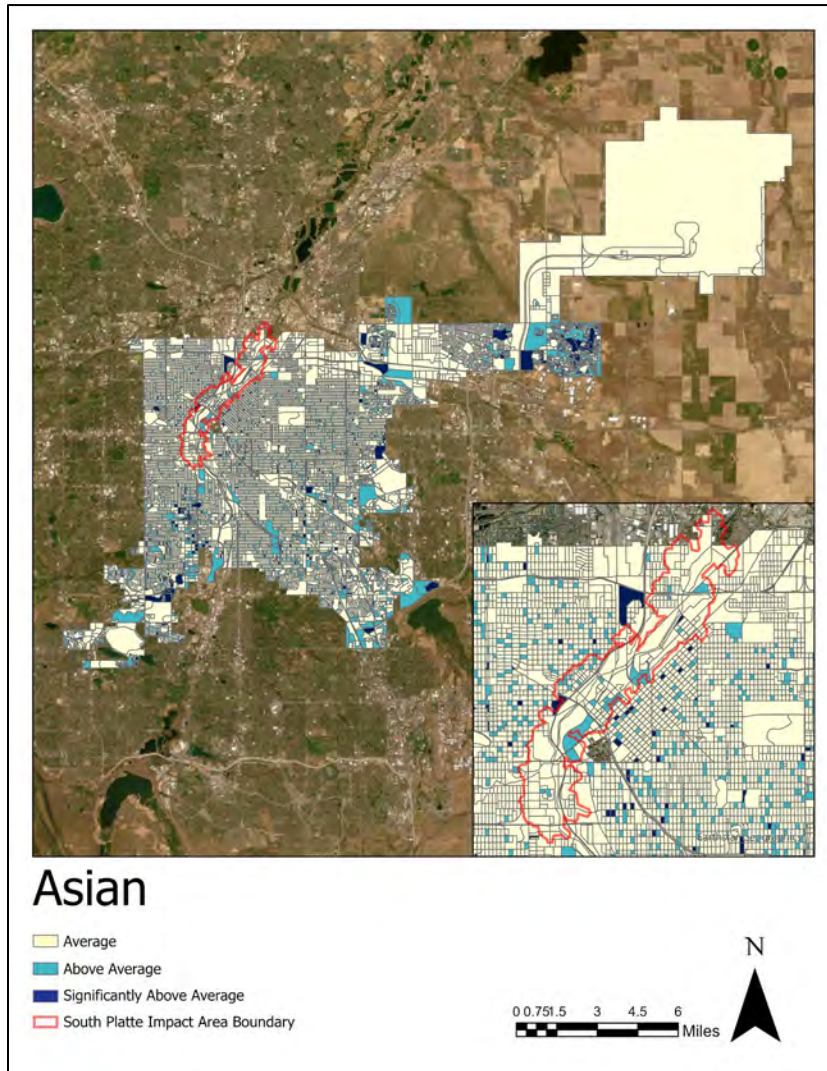


Figure A-15. Proportion of Asian residents inside and outside reanalysis area boundaries.

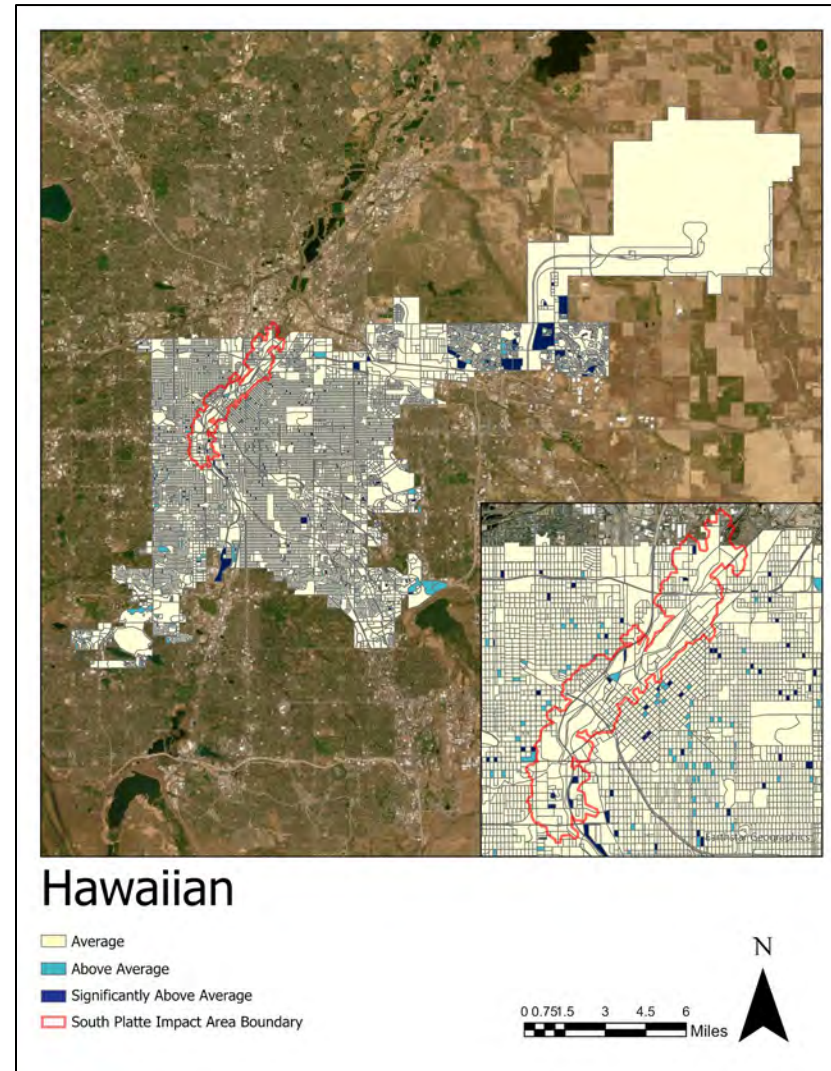


Figure A-16. Proportion of Hawaiian residents inside and outside reanalysis area boundaries.

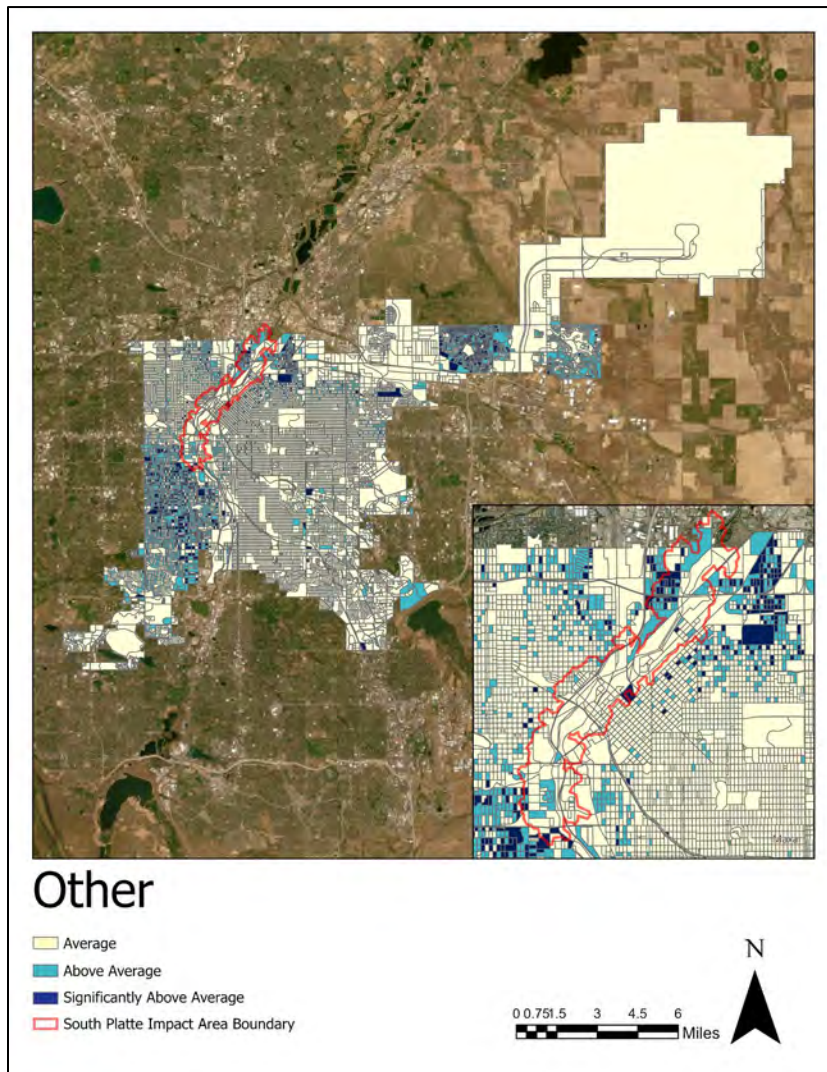


Figure A-17. Proportion of Other residents inside and outside reanalysis area boundaries.

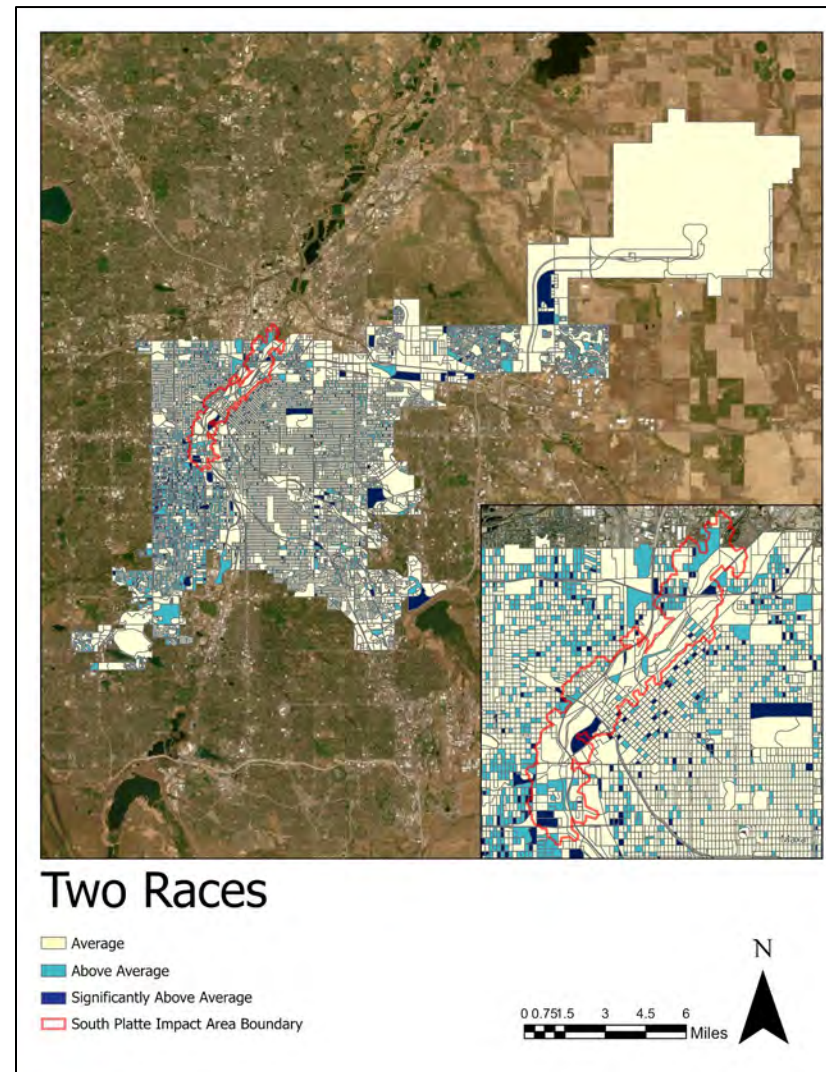


Figure A-18. Proportion of residents identifying as Two Races inside and outside reanalysis area boundaries.

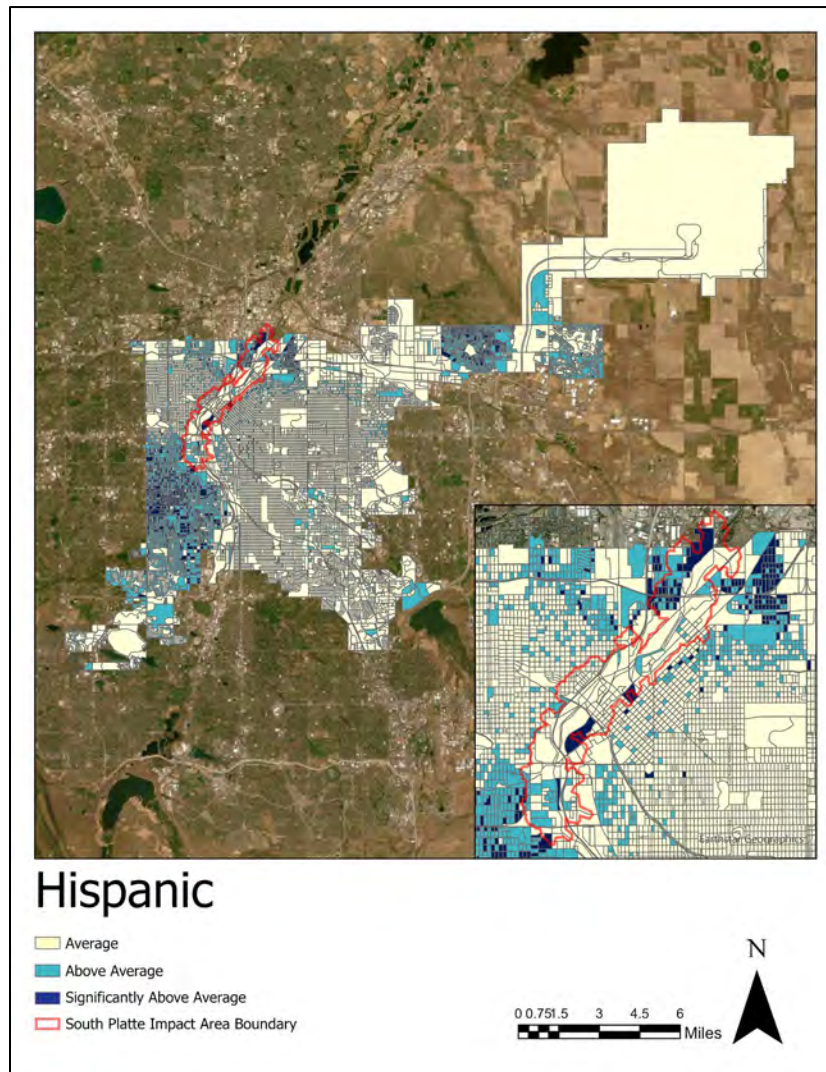


Figure A-19. Proportion of Hispanic residents inside and outside reanalysis area boundaries.



A.3.3 Weighted Benefits

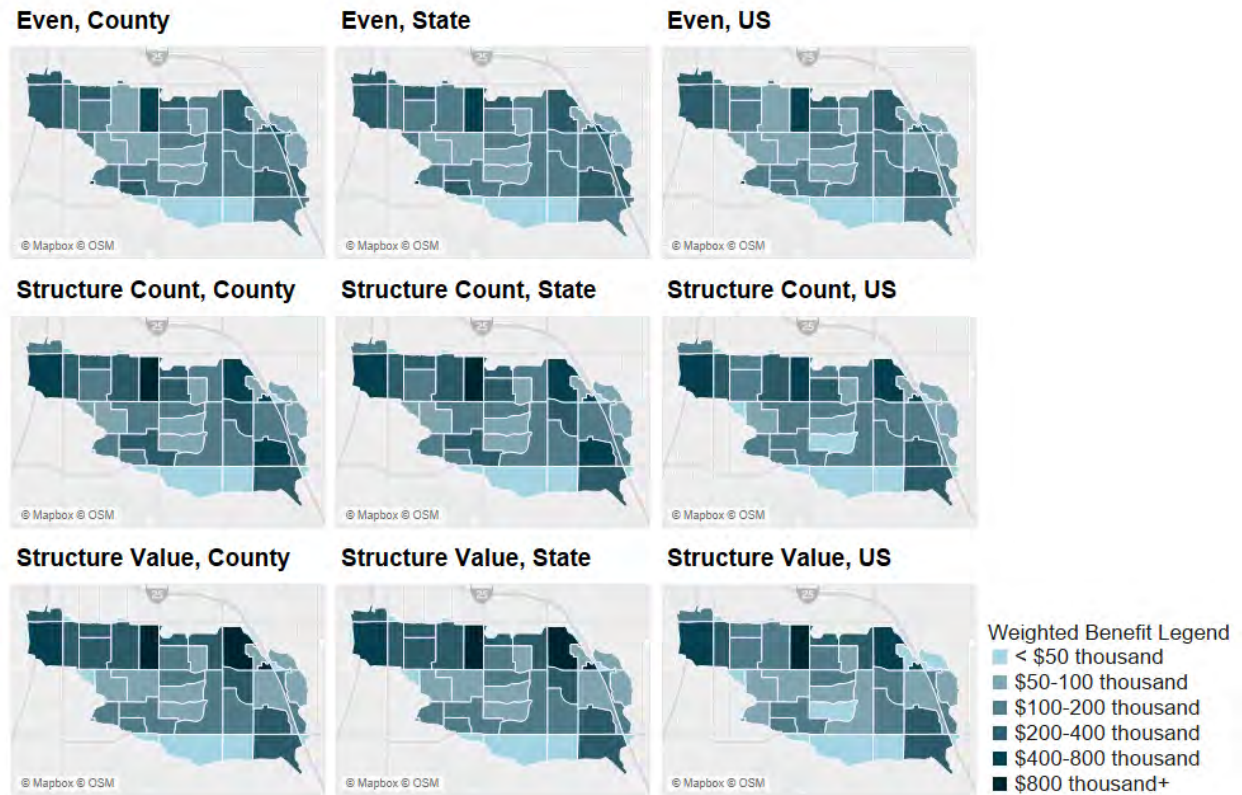


Figure A-20. Weighted benefit by allocation approach and comparison baseline.



A.4 SOUTHWEST COASTAL LOUISIANA

A.4.1 Demographics

Table A-6 Southwest Coastal Louisiana demographics: ecosystem restoration benefit area (Manson et al., 2023).

Category	Located in Ecosystem Restoration Benefit Area		Located Outside Ecosystem Restoration Benefit Area		Reference Area Total	% of Total Reference Area Population
	Count	%	Count	%		
White	186,304	66.6%	2,410,334	55.1%	2,596,638	55.7%
Black	62,755	22.4%	1,389,662	31.7%	1,452,417	31.2%
Native American	1,101	0.4%	24,893	0.6%	25,994	0.6%
Asian	5,063	1.8%	80,273	1.8%	85,336	1.8%
Hawaiian	147	0.1%	1,559	0%	1,706	0%
Other	1,031	0.4%	15,923	0.4%	16,954	0.4%
Two Races	9,483	3.4%	146,601	3.3%	156,084	3.4%
Total	279,761		2,410,334		4,657,666	
Hispanic	13,877	5%	4,069,245	7.1%	322,537	6.9%



A.4.2 Locations of Underserved Communities

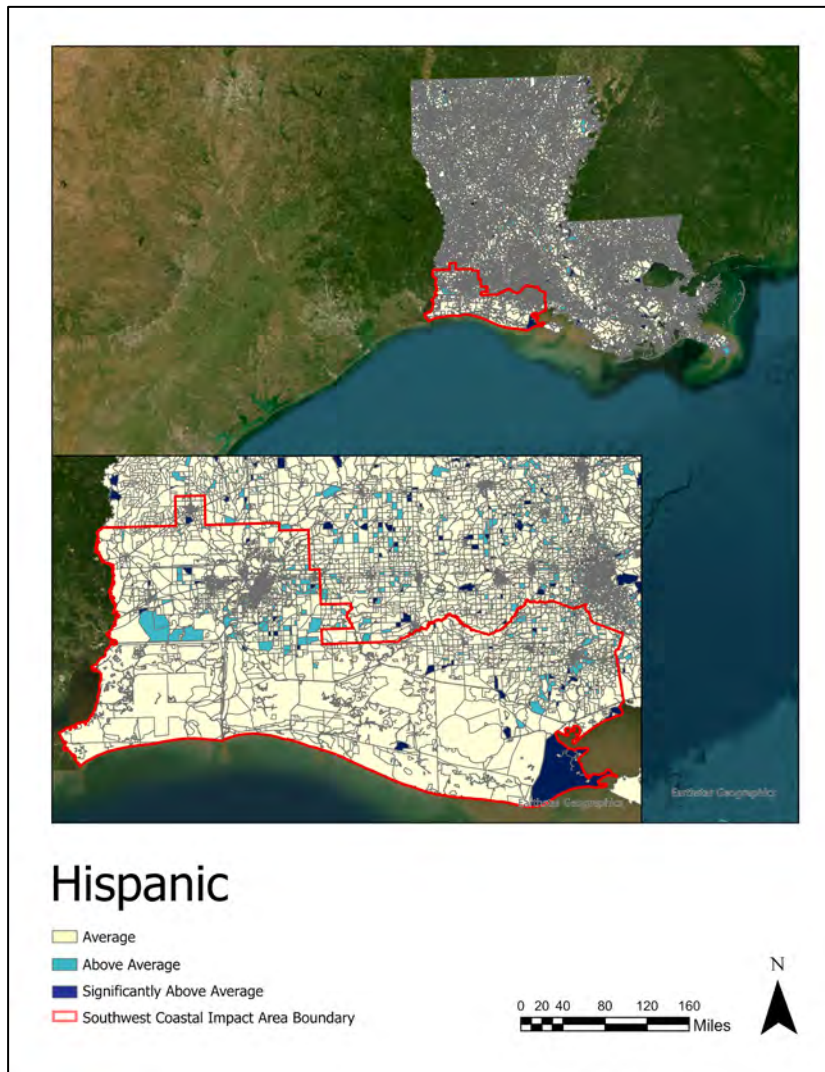


Figure A-21 through

Figure A-27 below demonstrate locations throughout the state of Louisiana (the reference area) and the impact area (Calcasieu, Cameron, and Vermillion Parishes) where concentrations of different racial and ethnic groups are average, above average, and significantly above average. These maps reference racial and ethnic groups that are more likely to live within the impact area (even when only slightly more likely).

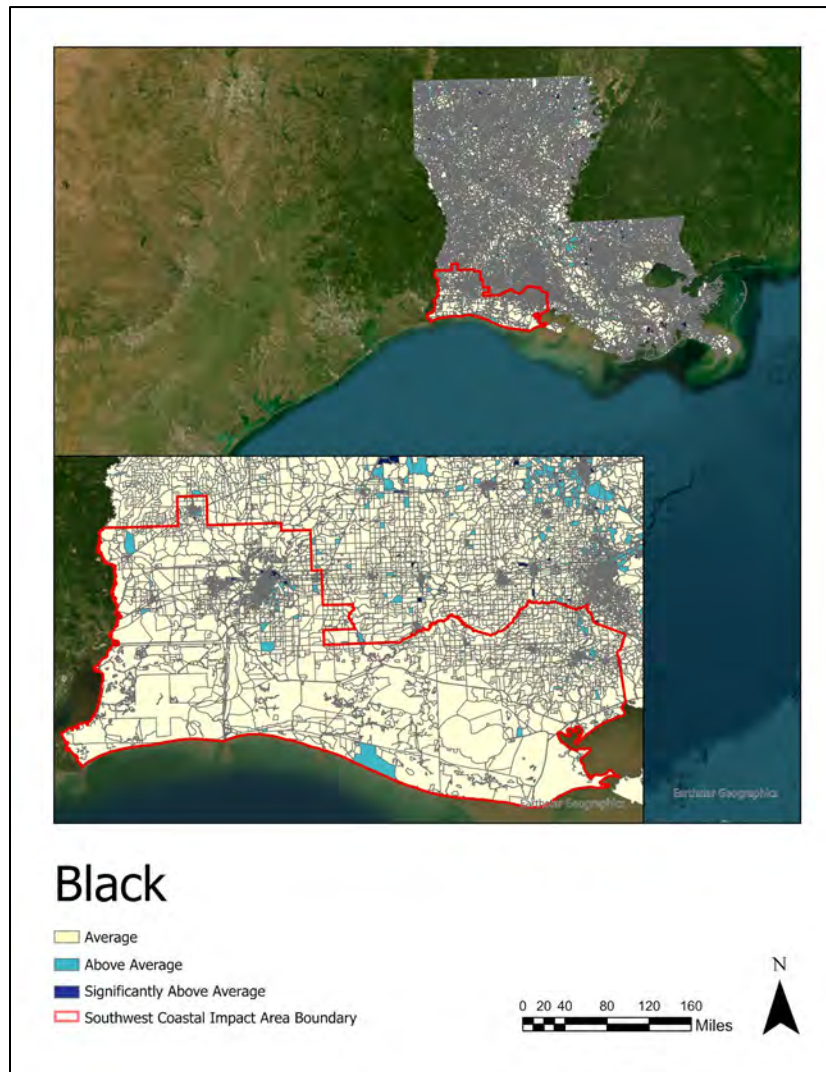


Figure A-21. Proportion of Black residents inside and outside reanalysis area boundaries.

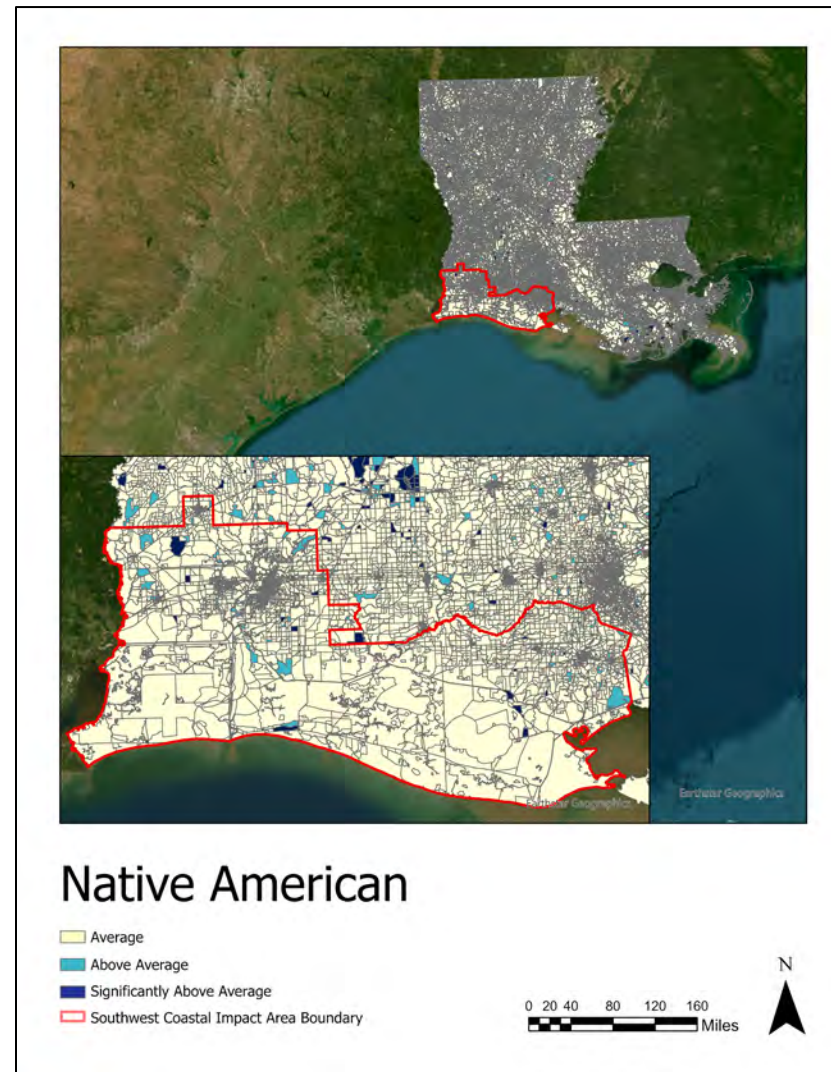


Figure A-22. Proportion of Native American residents inside and outside reanalysis area boundaries.



Figure A-23. Proportion of Asian residents inside and outside reanalysis area boundaries.



Figure A-24. Proportion of Hawaiian residents inside and outside reanalysis area boundaries.

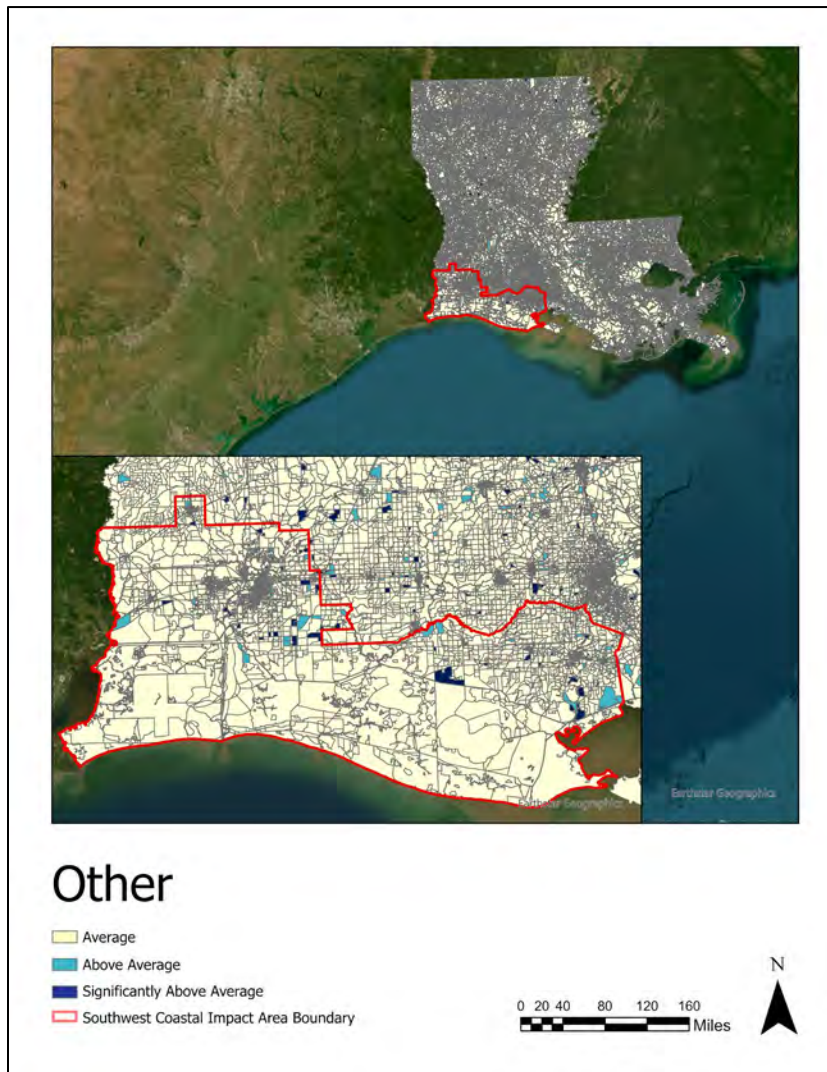


Figure A-25. Proportion of Other residents inside and outside reanalysis area boundaries.

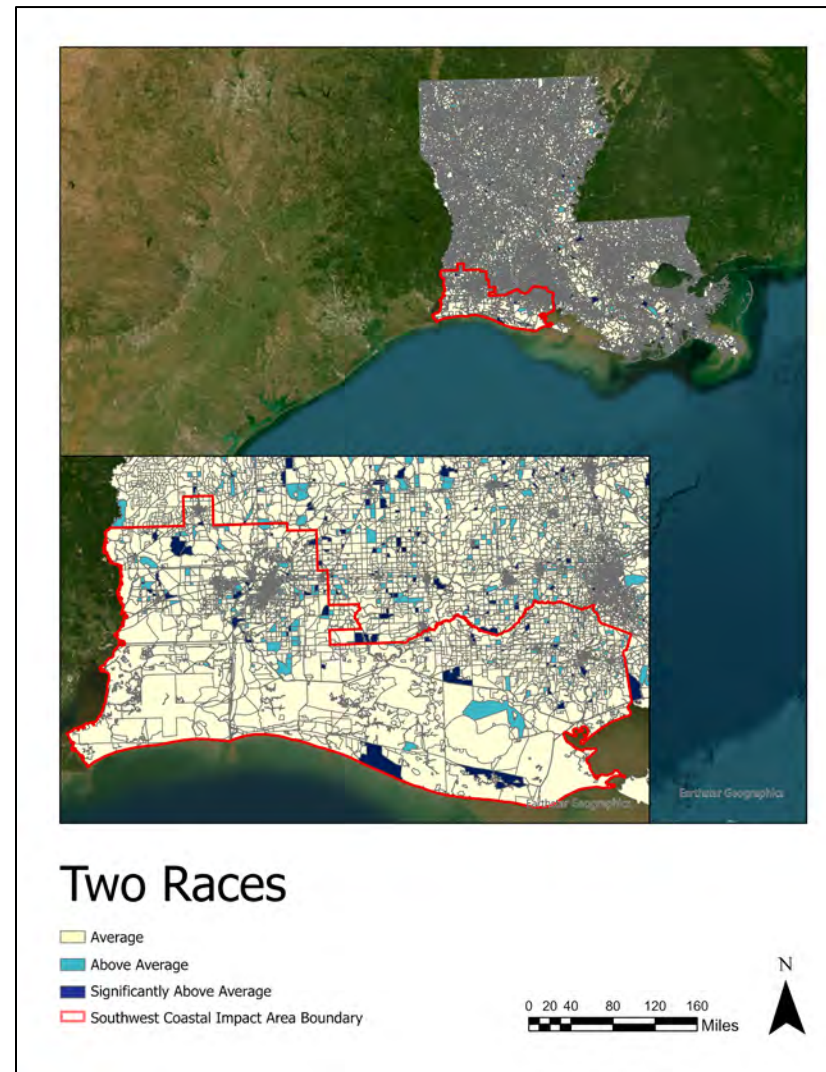


Figure A-26. Proportion of residents identifying as Two Races inside and outside reanalysis area boundaries.

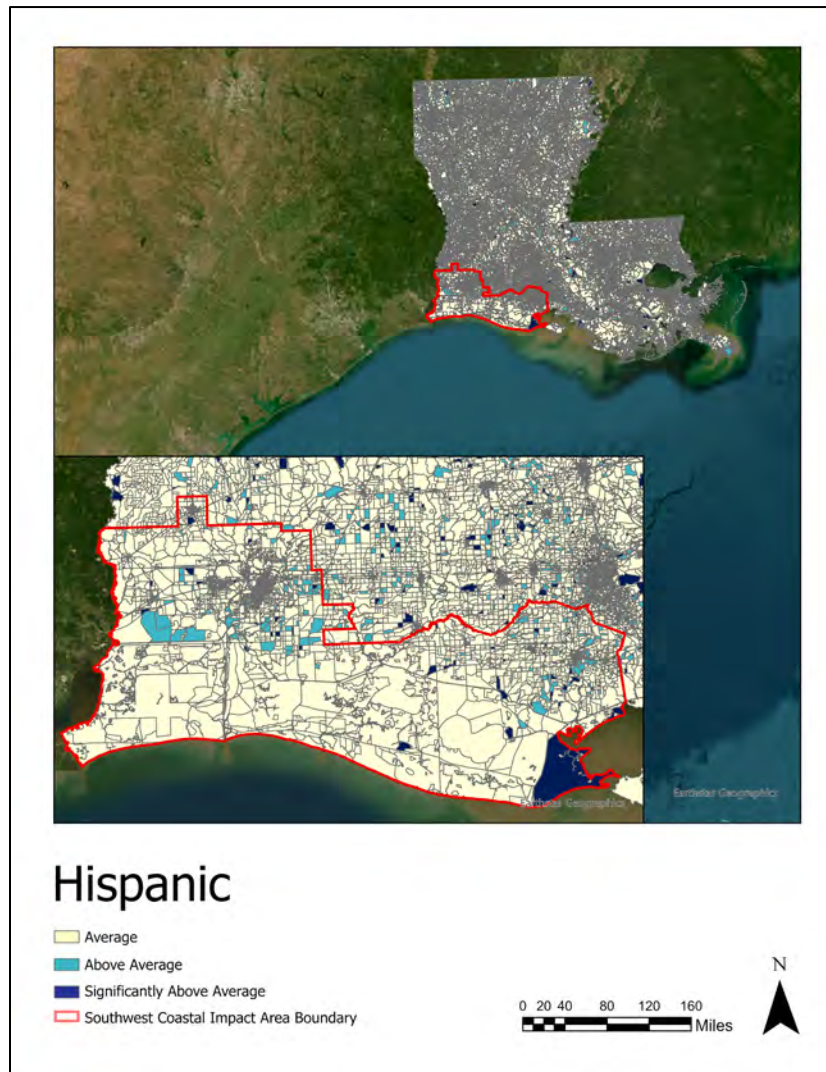


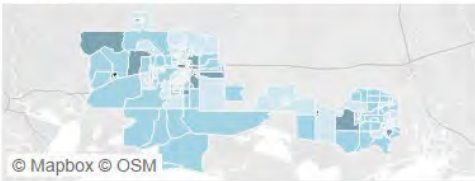
Figure A-27. Proportion of Hispanic residents inside and outside reanalysis area boundaries.



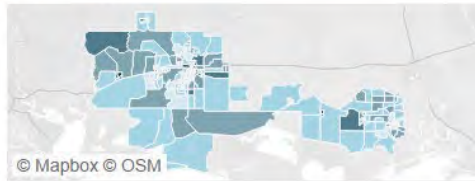
A.4.3 Weighted Benefits

Weighted Benefit by Allocation Approach and Comparison Baseline

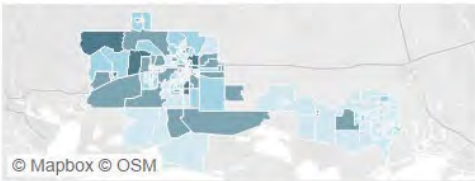
Even, State



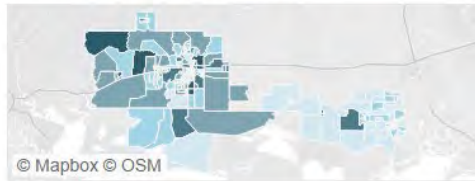
Even, US



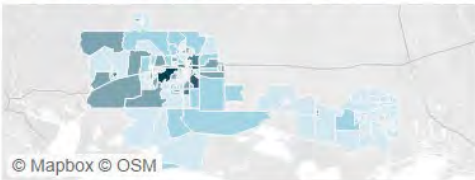
Structure Count, State



Structure Count, US



Structure Value, State



Structure Value, US

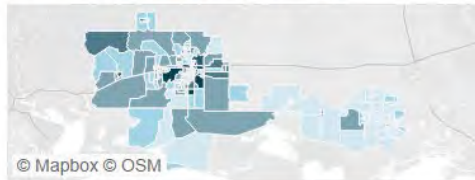


Figure A-28. Weighted benefit by allocation approach and comparison baseline.



A.5 JAMAICA BAY: HUDSON-RARITAN ESTUARY

A.5.1 Demographics

Table A-7. Jamaica Bay HRE demographics: recreation access benefit area (Manson et al., 2023).

Category	Located in Recreation Access Benefit Area		Located Outside Recreation Access Benefit Area		Reference Area Total	% of Total Reference Area Population
White	10,451	12%	593,420	25.5%	603,871	25.1%
Black	55,564	63.7%	886,370	38.2%	941,934	39.1%
Native American	606	0.7%	21,077	0.9%	21,683	0.9%
Asian	2,284	2.6%	319,400	13.8%	321,684	13.3%
Hawaiian	53	0.1%	1,707	0.1%	1,760	0.1%
Other	10,419	11.9%	284,991	12.3%	295,410	12.3%
Two Races	7,897	9%	215,661	9.3%	223,558	9.3%
Total	87,274		2,322,626		2,409,900	
Hispanic	18,544	21.2%	418,671	18%	437,215	18.1%

A.5.2 Locations of Underserved Communities

Figure A-29 through Figure A-35 below demonstrate locations throughout the Jamaica Bay study area (used as the reference area) and the 10-minute walking buffers (the impact area) where concentrations of different racial and ethnic groups are average, above average, and significantly above average. These maps reference racial and ethnic groups that are more likely to live within the impact area (even when only slightly more likely).

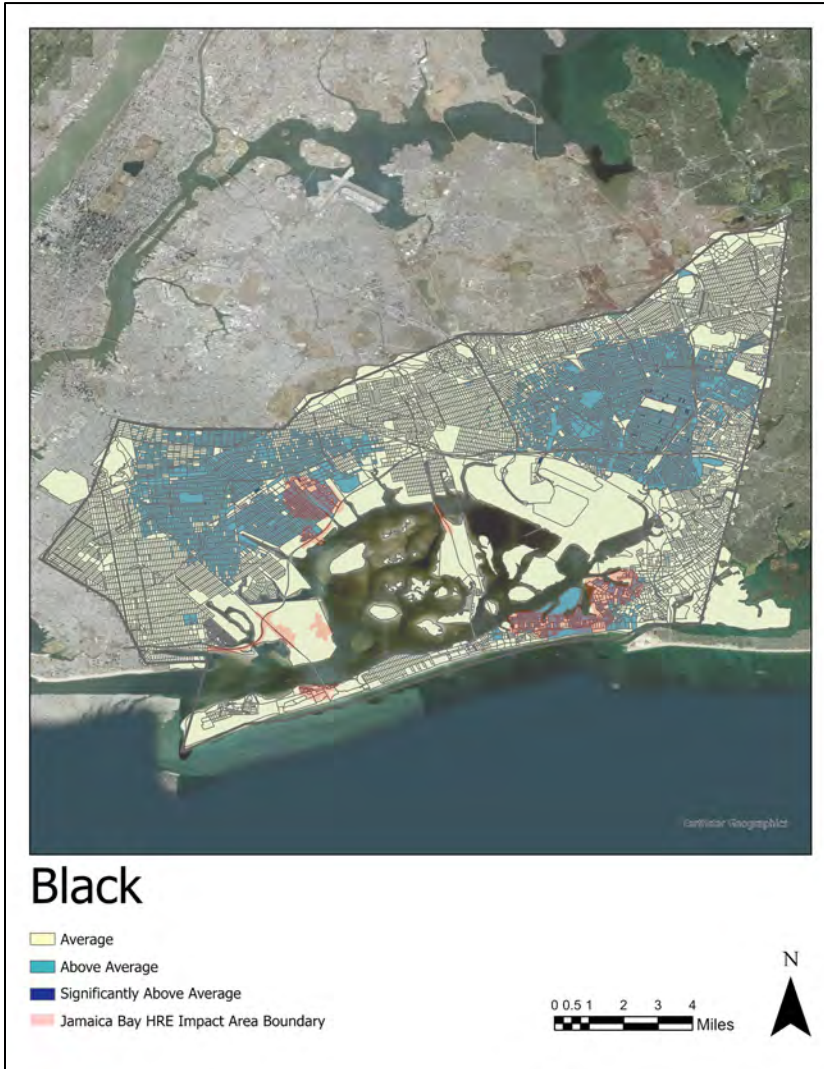


Figure A-29. Proportion of Black residents inside and outside reanalysis area boundaries.



Figure A-30. Proportion of Native American residents inside and outside reanalysis area boundaries.



Figure A-31. Proportion of Asian residents inside and outside reanalysis area boundaries.



Figure A-32. Proportion of Hawaiian residents inside and outside reanalysis area boundaries.

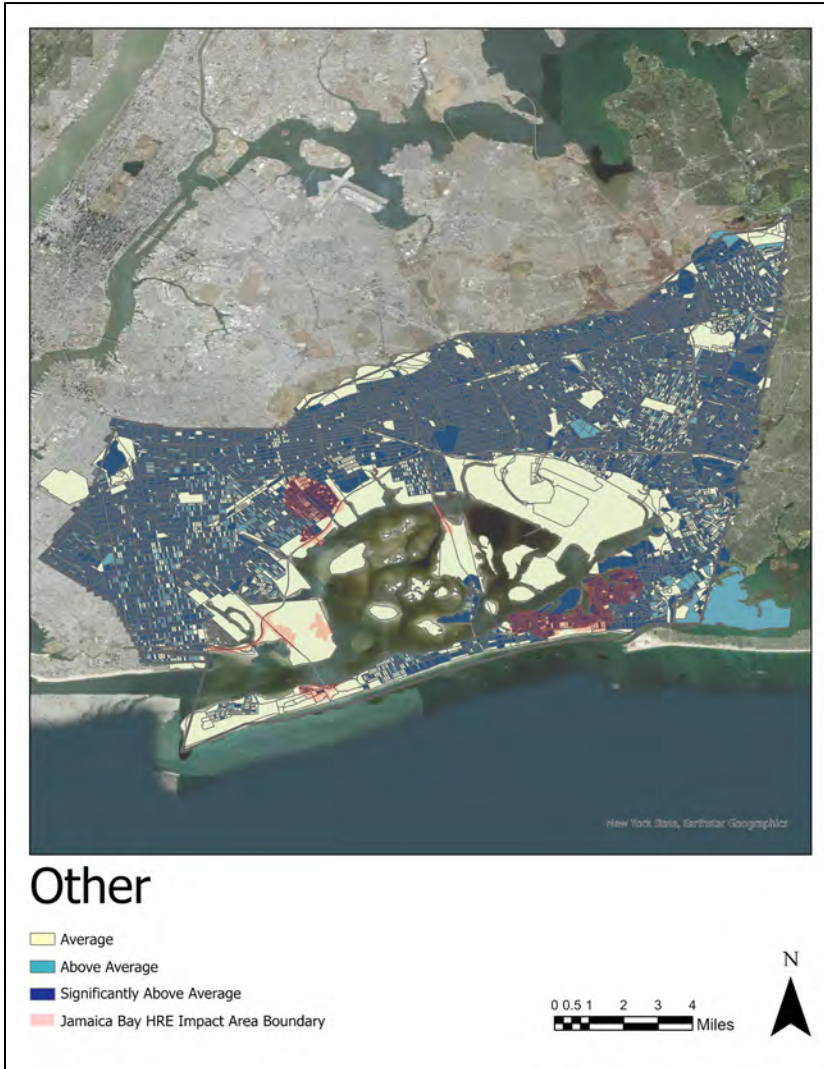


Figure A-33. Proportion of Other residents inside and outside reanalysis area boundaries.

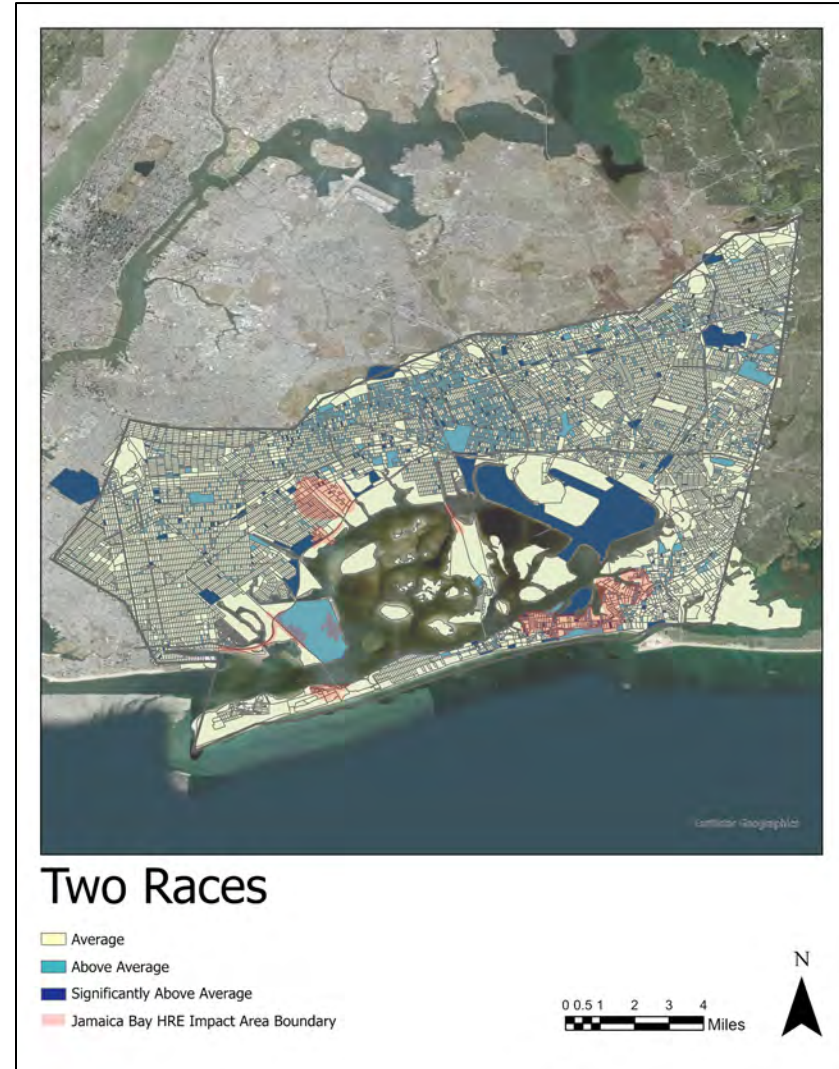


Figure A-34. Proportion of residents identifying as Two Races inside and outside reanalysis area boundaries.

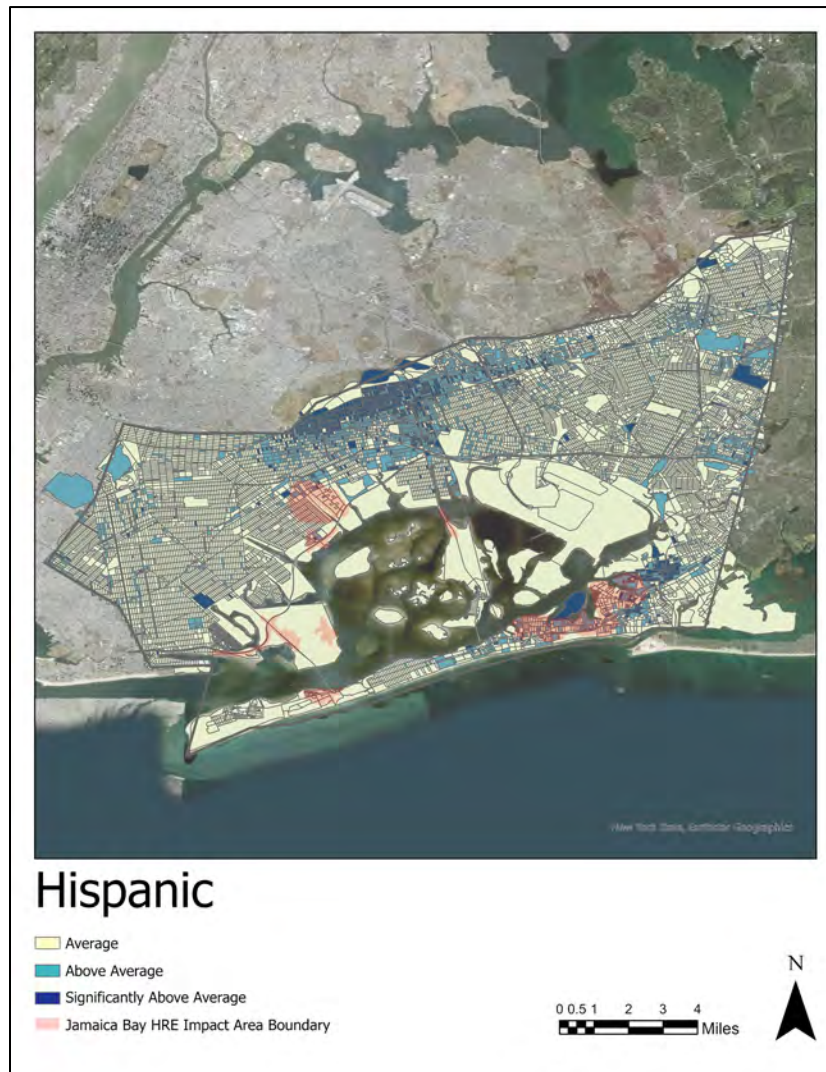


Figure A-35. Proportion of Hispanic residents inside and outside reanalysis area boundaries.



A.5.3 Weighted Benefits

Because the Jamaica Bay HRE study only used a single method for allocating benefits amongst block groups, the only variation comes from reference income. While the choice of reference incomes does scale the weighted benefits up or down, it does not alter the distribution of benefits and thus the overall pattern appears similar across the different reference incomes.



A.6 JAMAICA BAY: HURRICANE SANDY GENERAL REEVALUATION REPORT

A.6.1 Demographics

Table A-8. Jamaica Bay HSGRR demographics: Mid-Rockaway FRR benefit area (Manson et al., 2023).

Category	Located in Mid-Rockaway Flood Risk Reduction Benefit Area		Located Outside Mid-Rockaway Flood Risk Reduction Benefit Area		Reference Area Total	% of Total Reference Area Population
	Count	%	Count	%		
White	8,064	16.3%	600,674	25.3%	608,738	25.2%
Black	26,534	53.5%	917,816	38.7%	944,350	39%
Native American	504	1%	21,248	0.9%	21,752	0.9%
Asian	1,922	3.9%	321,009	13.5%	322,931	13.3%
Hawaiian	44	0.1%	1,729	0.1%	1,773	0.1%
Other	7,565	15.3%	288,780	12.2%	296,345	12.2%
Two Races	4,962	10%	219,514	9.3%	224,476	9.3%
Total	49,595		2,370,770		2,420,365	
Hispanic	13,278	26.8%	425,494	17.9%	438,772	18.1%

Table A-9. Jamaica Bay HSGRR demographics: Cedarhurst-Lawrence FRR benefit area (Manson et al., 2023).

Category	Located in Cedarhurst-Lawrence Flood Risk Reduction Benefit Area		Located Outside Cedarhurst-Lawrence Flood Risk Reduction Benefit Area		Reference Area Total	% of Total Reference Area Population
	Count	%	Count	%		
White	897	83%	607,841	25.1%	608,738	25.2%
Black	8	0.7%	944,342	39%	944,350	39%
Native American	2	0.2%	21,750	0.9%	21,752	0.9%
Asian	47	4.3%	322,884	13.3%	322,931	13.3%
Hawaiian	0	0%	1,773	0.1%	1,773	0.1%
Other	84	7.8%	296,261	12.2%	296,345	12.2%
Two Races	43	4%	224,433	9.3%	224,476	9.3%
Total	1,081		2,419,284		2,420,365	
Hispanic	120	11.1%	438,652	18.1%	438,772	18.1%

A.6.2 Locations of Underserved Communities

Figure A-36 through Figure A-42 below demonstrate locations throughout the Jamaica Bay HSGRR study area (used as the reference area) and the FRR project benefit areas where concentrations of different racial and ethnic groups are average, above average, and significantly above average. These maps reference racial and ethnic groups that are more likely to live within the benefit area (even if when slightly more likely).



Figure A-36. Proportion of Black residents inside and outside reanalysis area boundaries.



Figure A-37. Proportion of Native American residents inside and outside reanalysis area boundaries.

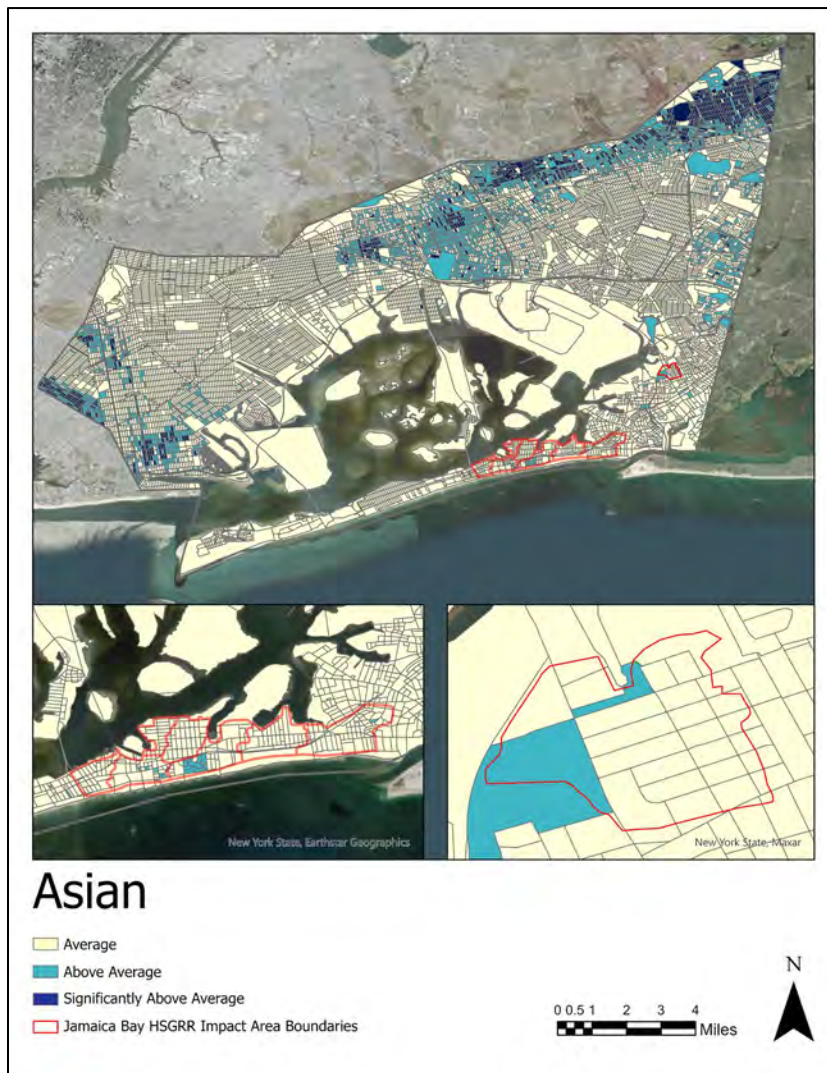


Figure A-38. Proportion of Asian residents inside and outside reanalysis area boundaries.

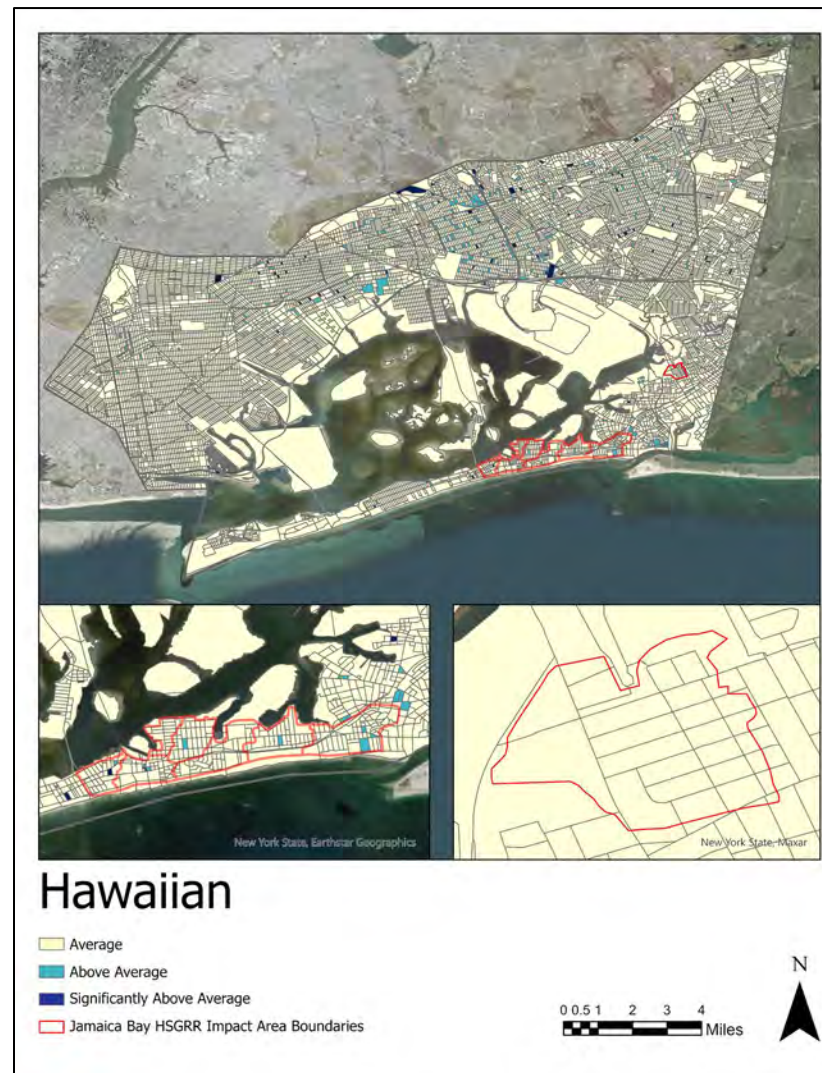


Figure A-39. Proportion of Hawaiian residents inside and outside reanalysis area boundaries.



Figure A-40. Proportion of Other residents inside and outside reanalysis area boundaries.



Figure A-41. Proportion of residents identifying as Two Races inside and outside reanalysis area boundaries.



Figure A-42. Proportion of Hispanic residents inside and outside reanalysis area boundaries.



A.6.3 Weighted Benefits



Figure A-43. Weighted benefit by allocation approach and comparison baseline.



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