



RESEARCH REPORT

Equitable Investments in Resilience

A Review of Benefit-Cost Analysis in Federal Flood Mitigation Infrastructure

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June 2021



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Acknowledgments

This report was funded by the Miami Foundation. We are grateful to them and to all our funders, who make it possible for Urban to advance its mission.

The views expressed are those of the authors and should not be attributed to the Urban Institute, its trustees, or its funders. Funders do not determine research findings or the insights and recommendations of Urban experts. Further information on the Urban Institute’s funding principles is available at urban.org/fundingprinciples.

The authors would like to thank the staff at the Miami Foundation who managed and contributed to this work, including Loren Parra and De’Sean Weber. The authors also thank the members of the Miami Foundation’s advisory committee who shared their insights and experiences to inform research processes and findings: Zelalem Adefris, Mayra Cruz, Shannon Cunniff, Steve Koller, Dr. Earthea Nance, Dawn Shirreffs, Christof Spieler, and Dr. Tiffany Troxler.

Executive Summary

The assignment of monetized value to property has often served to devalue people. In the United States, that has historically meant that the possessions of people with low incomes and people of color are undervalued and frequently overlooked in public investment. The allocation of resources for public works designed to protect people from a range of environmental hazards, including floods, are no exception.

Federal, state, and local governments have built structures, defenses, and related physical interventions to minimize the exposure of assets to flooding since the nation's independence. Over time, the assets and their loss have been largely defined in financial terms, regardless of the costs of reconstructing the assets or the disproportionate impact of their loss on the residents and surrounding community. Contemporary tools to define and compare the values of assets and losses such as benefit-cost analyses are in place under the premise that they are place- and people-neutral. Yet increasing physical and sociological evidence suggest that these tools may perpetuate social, economic, and environmental disparities in process, product, and outcome. Equity, contemporarily defined, is still more aspiration than achievement.

The Miami Foundation partnered with the Urban Institute to review the policy and practice of benefit-cost analyses (BCAs) and their consideration of equity through case studies of purposively selected federally funded flood mitigation investments. This report (1) summarizes the state of federal BCA requirements in relation to social equity considerations, (2) synthesizes observations about BCA's implementation as observed across the case studies, and (3) provides recommendations for adjustments in BCA methods, protocols, and interpretations to better serve equitable goals.

Findings

- **Innovative benefits in BCAs are rare, and calculation of the distribution of benefits is the exception, not the rule.** Historically in BCAs, benefits have been defined in the most conservative terms and almost always in relation to property and the losses (e.g., property damage) that have been avoided because of flood mitigation infrastructure. Only recently have federal grantees and officials considered more innovative benefits, ranging from ecosystem services, to the maintenance of social networks, to the indirect benefits of securing financial well-being by costing out wraparound services that support affected households. The BCAs for

the BIG U project in New York City and Ohio Creek Watershed Project in Norfolk, Virginia—two of the cases examined in this report—exemplify these aspirational indicators. However, considering how benefits will be distributed across racial and income groups is still the exception in federal investment review, not the rule.

- **When project beneficiaries are broadly defined, historically disenfranchised or underresourced communities are deprioritized.** Unless statutorily required, a project’s beneficiaries are usually defined as a general, geographically bound population that is within a floodable region that the infrastructure defends. Secondary beneficiaries such as local businesses (which avoid revenue and productivity shortfalls) and governments, including emergency managers who would be tapped during flood events, are also frequently defined. Tertiary beneficiaries such as private insurers and rebuilding contractors are omitted overall. Exceptions to generalized definitions of beneficiaries come when jurisdictions champion an exclusive focus on—or, at least, a focus that deliberately includes—historically disenfranchised communities beyond requirements. The Antelope Valley Redevelopment Project of Lincoln, Nebraska, exemplifies this intentionality.
- **BCA can be one among many determining criteria for project selection and prioritization.** BCA analyses have benefited from expert consultants who have pushed the boundaries of beneficiary definitions and the methods of quantification within federal allowances. Consequently, the resulting benefit-cost ratios have ranged widely for reasons beyond each project’s objective differences in costs and outputs: the cases include ratios from 0 to 9.4. Arguably, the more relevant finding from the cases is whether the BCA was viewed as the most critical deciding factor for a federal green light or whether it was one of several analyses, if considered at all. For the home acquisition project in Friendswood, Texas, for example, the ratio was moot given the severity of flood exposure. The Antelope Valley Redevelopment Project supplemented the BCA required for one portion of its plans with multiple other economic, sociological, heritage, and land development studies.
- **Robust community engagement is necessary to advance equity and secure public buy-in.** Community engagement in all the cases met their federal funder requirements, though these requirements varied widely from extensive presentations, meetings, and consultations with grassroots leaders to limited, perfunctory public announcements and minimal hearings. In several cases, community representatives noted that attempts at engagement were minimal and insufficient or, at worst, purposely obfuscating. This occurred with the BIG U when community members were temporarily left in the dark at a critical moment in implementation

and in Friendswood as unexplained bureaucratic delays led some homeowners to forgo participation in the program. In all cases, community leaders noted that authentic and robust engagement would have made them more comfortable with their project's considerations of equity. A few respondents suggested that strong engagement would have led to more readily accepted projects and their outcomes.

- **Statutory requirements are a key to establishing BCA flexibility, prioritizing beneficiaries, and ensuring community engagement.** Statutory requirements from federal agencies make the difference in intentionally directing resources to vulnerable groups, permitting broader benefits, considering other qualitative and quantitative study beyond the BCA, and enforcing community engagement. For example, the low- and moderate-income requirements in US Department of Housing and Urban Development programs circumvented deliberations about whether and how BCA mattered. State and local jurisdictions are too often resource-strapped and slow to break local norms.

Recommendations

- **BCA flexibility, criteria, and assumptions should be increased, but BCA should not be the sole criteria for determining infrastructure investments.** BCA can be improved with the inclusion of new constructs of benefits and harms that are most likely accrued by vulnerable populations, new methods for measuring them, and new ways of assessing the distribution of benefits and harms across populations. Yet BCA findings cannot be the sole determinant of infrastructure investments. They must be supplemented with other study during decisionmaking and consistently followed by ex post evaluation to ensure that BCA measures are accurate and can be further improved and to rectify any unanticipated harms or unexpected costs.
- **Community engagement is necessary to both advancing equity and ensuring project success.** Community engagement is fundamental in general and in relation to communicating the complexities of BCA. By ensuring that people and organizations are part of the project's definitions, designs, and outcomes, project proponents can produce a better project and one that meets its community's needs. In several cases, community groups noted that a robust and authentic engagement process could have ensured project equity that even the most thoughtful of BCAs could not yield.
- **Historical disparities from past policies and projects should be addressed in new infrastructure plans.** Comprehensive equity efforts must not just try to create a fair game; they

must recognize that the playing field is not even. Recognizing historical and compounded disparities from past policies and discriminatory behaviors presumably leads to a different approach to processes and products such as different engagement techniques or alternative infrastructure approaches and designs. Information on the demographic, financial, environmental, and social needs and behaviors of the range of affected communities can ensure a better infrastructure decision and process.

- **Investments should prioritize the most vulnerable first.** Flood mitigation infrastructure is, ultimately, a safety net. Like other federal safety nets, flood investments should prioritize the most vulnerable, including households with low incomes and communities of color. With *a priori* requirements for who and where funds go, the federal government can ensure that BCAs do not erase the differences in need or exacerbate them.

Recent presidential executive orders modernizing regulatory review have affirmed the significance of appropriate and rigorous tools for reforming federal decisions, including capital investments like flood defenses and related structural interventions.¹ The Biden administration has also explicitly admitted to past injustices regarding the allocation, placement, and operations of these assets for different racial, ethnic, and income groups and affirmed the urgency of repairing their damage.² Further, the administration's concerns for "advancing economic opportunity, worker empowerment, and environmental mitigation, especially in disadvantaged communities and communities of color," while protecting federal investments from climate exposures such as floods suggest a unique political opening for addressing social equity in decision tools.³

Regardless of the current opportunity, changing demographics, expanding urbanization, and the increasing frequency and severity of floods because of global climate change demand that more attention be given to defining what and what places we value and, ultimately, who we choose to defend. Methods, data, and tools such as quantitative benefit-cost analysis can be improved toward that objective. However, these tools must be implemented in coordination with rigorous qualitative assessment, citizen engagement, commensurate financial resources, and leadership from the grassroots to the White House to, as our constitution notes, "provide for the common defense."

Introduction

Climate change and social equity intersect across multiple dimensions, including with public investments for protecting vulnerable communities from environmental hazards. In the United States, the households that are the most financially, civically, and socially vulnerable in the places that are the most exposed to the effects of climate change are too often those that receive the least assistance for recovery after climate-related hazards such as floods. Furthermore, public works that can mitigate losses before hazards occur are repeatedly underfunded.

Consequently, projects ranging from home elevations and buyouts, to neighborhood-level levees and water retention ponds, to massive wetlands conservation and seawalls are often prioritized for places and properties deemed to have the highest market value. At best, the assets of social networks, cultural heritage, natural patrimony, and community sense of place have been secondary considerations. At worst, they are intentionally disregarded and even purposefully devalued when residents are households with low incomes, neighbors of color, and neighborhoods of least political resistance.

The Miami Foundation partnered with the Urban Institute to review the policy and practice of benefit-cost analyses (BCAs) and their consideration of equity through case studies of purposively selected, federally funded flood mitigation investments. This report summarizes the state of federal BCA requirements in relation to social equity considerations, synthesizes observations about BCAs' implementation as observed across the case studies, and provides recommendations for adjustments in BCA methods, protocols, and interpretation to better serve equitable goals.

Background

Less noted and commented on than other presidential executive orders released in the first weeks of the Biden administration was a memorandum on modernizing regulatory review.⁴ Released on January 20, 2021, the memorandum calls for the White House Office of Management and Budget (OMB) to “provide concrete suggestions on how the regulatory review process can promote public health and safety, economic growth, social welfare, racial justice, environmental stewardship, human dignity, equity, and the interests of future generations.”⁵

One focus of reform—and the only to be noted specifically in the memorandum—are procedures that “take into account the distributional consequences of regulations, including as part of any

quantitative or qualitative analysis of the costs and benefits of regulations, to ensure that regulatory initiatives appropriately benefit and do not inappropriately burden disadvantaged, vulnerable, or marginalized communities.” Combined with other recent orders on environmental justice and racial equity, the assignments to OMB present a new direction in federal decisionmaking and serve as a reform of the status quo to refocus on people, rather than property. Furthermore, this movement goes well beyond the obvious regulatory reviews and adoptions as the rule for defining costs and assigning benefits that will inform all manner of projects—including most other planning, property acquisition and conversion, design, construction, and maintenance of facilities, public works, buildings, greenways, wetlands, and all manners of federal intervention. The maintenance of flood mitigation infrastructure and the design of future projects are, in theory, included.

As new White House committees and interagency working groups define and operationalize equity for projects, reviewing what has been done in the past and continues today could shed light on what might be.

Federal Flood Investments

The first step toward understanding what is being done is identifying who is doing it. For the purposes of this study, five agencies were identified as playing the most significant roles in flood mitigation infrastructure (Carter et al. 2019).⁶

- **US Army Corps of Engineers (USACE).** It is by far the largest and oldest source of federal funding for these projects. Through both project-specific and programmatic legal authorities and cost sharing with another nonfederal sponsor (typically a municipality or levee district), USACE assists with planning, design, and construction of projects that have a direct national benefit or address a public safety concern. Budget cuts beginning in the 1980s have forced this assistance to be competitive for the local sponsors and highly sought after by their congressional delegations. Recently, the average annual budget for the combined programs for these projects has typically been just under \$1 billion.⁷
- **Federal Emergency Management Agency (FEMA),** including the Federal Insurance and Mitigation Administration. FEMA’s Flood Mitigation Assistance Program, Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program, and new Building Resilient Infrastructure and Communities are better known than USACE’s programs but provide only slightly more funding. Furthermore, most of the resulting projects tend to be on smaller geographic scales, such as acquisition, retrofits, or elevations of individual properties;

protections of utilities or other critical infrastructure; and construction of safe rooms, shelters, and other crisis response facilities. However, FEMA's charge over dam maintenance and other security infrastructure and desire to minimize the exposure of properties with National Flood Insurance Program policies boost its importance among the family of flood mitigation agencies.

- **US Department of Housing and Urban Development (HUD).** HUD-funded flood mitigation projects include those supported through the Community Development Block Grant Disaster Recovery (CDBG-DR) Program's Rebuild by Design (RBD) competition, and the National Disaster Resilience Competition (NDRRC). The more recent Community Development Block Grant Mitigation Program is the latest agency member to fund flood mitigation. The outlays are massive, from \$1 billion each for the competitions and almost \$4 billion for the mitigation program. Because CDBG-DR is not a statutorily authorized program, appropriations come only during disaster recovery (Martín et al. 2021). Despite its infrequency, HUD's funding has resulted in massive flood projects, many garnering global attention (Martín et al. 2014). HUD is also the only agency whose funds are statutorily directed to households with low or moderate incomes (LMI).
- **US Environmental Protection Agency (EPA).** The agency's State Revolving Fund and Water Infrastructure Finance and Innovation Act occasionally fund storm water works that connect with flood plans and projects.
- **US Department of Agriculture.** The agency provides flood project-level assistance through its Watershed and Flood Prevention Operations and the floodplain easement in the Emergency Watershed Protection program, both typically to protect agriculture, fishery, and hunting interests.

Though working on similar missions regarding flood mitigation, each agency faces different appropriations variances, governing statutes, and operational program rules. They vary on whether they evaluate their projects' outcomes and compare them with original decision materials (Ramirez et al. 1988). They also have widely varying organizational cultures, informed in part by their specific roles—for example, FEMA as first responder or HUD as community developer—and by the demographic composition of their historical workforce (Sevison 2018).⁸ Regardless of their differences, OMB requires that they use benefit-cost analysis with shared principles and guidance.

Benefit-Cost Analysis

Assessing the benefits and costs of engineering and design projects has a long professional history in the US, with the mechanics of estimating both stemming from the development community's pro forma for private capital investments. Financial assessments for public works related to flood hazards were first codified, albeit loosely, into law with the Flood Control Act of 1936, which authorized USACE to encourage investments in flood controls "if the benefits to whomsoever they may accrue are in excess of the estimated costs, and if the lives and social security of people are otherwise adversely affected" (Durden and Wegner-Johnson 2013, 31).

The specifications of what could be reasonably defended as a beneficial effect (and, conversely, a harmful effect) have been a work in progress ever since (Committee to Assess the US Army Corps of Engineers Water Resources Project Planning Procedures et al. 1999). Fluctuating and confounding legislative changes to statutes, executive actions, and program practices have defined the contours of specific benefits' definitions, their consistent operationalization and measurement, and the interpretation and use of the singular number that is produced—the benefit-cost ratio (BCR)—as a determinant for action (Krutilla 1966). For postwar infrastructure investments, the analysis and its resulting calculation were relatively straightforward, relying on the costing concepts and benefit measurement procedures in the "Green Book," a document that was revised and retitled in 1958 as "Proposed Practices for Economic Analysis of River Basin Project" (Yoe and Orth 1996). The economic benefits of protecting property determined through existing property values was literally and euphemistically pro forma until the 1965 Water Resources Planning Act required the creation of the "Principles and Standards of Planning Water and Related Land Resources," which was the precursor to the contemporary "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies," or "P&G."⁹

By the late 1960s, however, policy debates emerged over the use of BCA for a different federal decisionmaking purpose: environmental regulation. The National Environmental Policy Act of 1969 required the clear and consistent consideration of four "accounts" to assess all significant effects of any planned federal rules: national economic development, environmental quality, regional economic development, and "other social effects."¹⁰ The last category includes "urban and community impacts and effects on life, health and safety." Rules for BCAs in environmental regulation, then, informed those of BCAs for infrastructure investment. The 1970 Flood Control Act required that a wider pull of factors related to social well-being be integrated into USACE decisions, such that "the possible adverse economic, social and environmental effects...have been fully considered, and that the final decisions are made in the best overall public interest."¹¹

Reductions in the USACE's budget for managing water resources and the deregulation movement of the 1980s led to delays in the theoretical methods and practical applications of these new specifications for evaluating the costs and benefits of federal interventions of all kinds, including flood mitigation infrastructure (Livermore and Revesz 2011). The effort by conservative politicians to put all proposed regulations to a financial test culminated in President Reagan's 1981 presidential executive order that codified BCA as a tool for reviewing proposed regulatory change in both legislation and program rules and centralized that review within OMB. Soon after, equivalent requirements were instituted for all federal investments, particularly any engineered infrastructure and public works at USACE, FEMA (under the mitigation programs established in the 1988 Stafford Act), and HUD's CDBG-DR (starting in 1993). Reagan's executive order was later supported and only slightly amended by President Clinton in a 1993 executive order (No. 12866) that added transparency requirements and approaches for addressing unquantified costs and benefits and suggested a role for quantifying the distribution of costs and benefits in future BCAs. Other tools such as FEMA's Hazards in the US System (HAZUS) were developed to further federal decisionmakers' analytical capacity (Schneider and Schauer 2006).

By the early 2000s, BCA was an established tool. Advocates, especially environmental groups, fought the application of BCA throughout this time. Yet, with political support continuing through the present, BCA has become firmly established in federal rulemaking and statutes for regulatory decisions and infrastructure investments of all kinds.¹² The methods of BCA and the significance of BCA findings for project approvals were modestly tweaked during the Obama administration but upheld nonetheless.¹³ Rather than fight it, advocacy groups have since turned to improving BCA by quantifying and integrating previously undocumented benefits and costs, as well as pushing for more accurate measurement, accounting for disparities in the distribution of benefits and costs, and integrating community input in its development (Revesz and Livermore 2008).

Equity and Benefit-Cost Analysis

Individual projects funded across the federal government must continue to meet the same cost-effectiveness tests, tailored to each agency (URS Group 2009).¹⁴ A few BCA components, such as the appropriate discount rate, have been the source of debate among economists, environmentalists, and federal budget advocates.¹⁵ Three categories of benefits rank among the most contentious and complex. First, the quantification of avoided future losses requires the prediction of flood damages, which, in turn, requires the quantified values of assets, among other inputs (Economist Intelligence Unit 2016; National Institute of Building Sciences 2018; Shreve and Kelman 2014). The value of ecosystem services, measured through willingness-to-pay surveys or direct public and private revenues from

preserved or enhanced natural ecologies, has advanced considerably but is still evolving (Boardman et al. 2018; Gramlich 1990). Yet the full range of social effects beyond property losses that stem directly from the intervention or the losses that the intervention mitigates are not quantified, and neither are distribution of effects—particularly for different groups by demography or exposure—or the beneficiaries of outcomes. The latter category is directly relevant to equity concerns and, arguably, has received the least scholarly inquiry or policy advocacy (Revesz 2018). It was not until the release of USACE’s “Planning in a Collaborative Environment” in May 2005 that the quantification of “other social effects” became a central subject of BCA reform (Laska and Gramling 2008). This dilemma is due in part to the challenges associated with equity’s quantification and to the purported neutrality of the BCA tool overall. Simply, equity complicates BCA. Proponents of equity perspectives argue that investments must be predicated on fully inclusive engagement with communities to comprehensively review all impacts and “co-benefits,” or the multiple loss-avoidance, social, economic, and environmental benefits to be gained from holistic planning and a long-term vision. Equitable infrastructure may be more expensive than traditional infrastructure, but it should yield more benefits of a greater magnitude than its counterparts that are solely framed as flood mitigation efforts.

Some argue that BCA cannot and should not fully account for equity and that equity considerations are better left for impact analysis, be it environmental, health, or economic (Williams and Broughel 2015). Others assume that program eligibility rules or alternative policy criteria should determine how equity is considered. Regardless of the process, few argue that social equity should not be a factor in flood infrastructure decisionmaking as popular media have begun to report on what has been known by scholars and the experiences of disaster-vulnerable people.¹⁶ Yet as the central arbiter for implementing BCA and other requirements across federal agencies, OMB has been relatively silent until now (Livermore and Revesz 2013). The current moment is ideal to explore new paths.

Project Approach and Methods

The Miami Foundation partnered with the Urban Institute to review the policy and practice of including social equity in BCAs as they are implemented in federal flood resilience investments. According to the foundation’s charge, Urban sought to answer the following descriptive questions:

- How is social equity considered, or not, in current federal flood infrastructure decisionmaking?
- What are the characteristics of tools like BCA and related federal processes that define equity as a consideration?
- How might BCA and federal processes change to consider equity?

Urban used a rigorous qualitative approach to (1) define and articulate the landscape of federally funded flood control infrastructure projects and their relevant statutes, regulations, and program rules; (2) categorize and select cases for exploration through consistent criteria; and (3) develop a peer-reviewed plan for collecting and analyzing qualitative data from structured interviews and standardized coding of documents to build five cases. Through cross-case comparison supplemented with expert input, Urban also developed recommendations that shed light on how federal investments can integrate and advance equity through this specific tool.

Landscape and Case Population

Urban scanned the population of federally funded flood control and mitigation investment channels and identified their statutory, regulatory, and program rules in relation both to BCA requirements, methods, and interpretation and to equity for historically underserved and vulnerable populations either as an investment criterion or subjective consideration. Consequently, the researchers included projects from the relevant federal agencies identified in the background review.

Agency-specific BCA methods; authorizing vehicle policy or legislation; and program rules, eligibility requirements, and policies were collected and reviewed for each of the identified agencies (see table A.1 in the appendix). These documents were evaluated for their eligibility requirements, explicit and implicit references to equity or acknowledgment of underserved populations, and BCA criteria. Urban then accessed the population of all flood mitigation investments—or, rather, those explicitly classified by the agencies as federal mitigation—in the last 10 years to define the population of potential cases to be purposively sampled.

Case Selection

To solicit recommendations for case selection criteria, Urban supplemented its review of the scholarly and policy literature on BCA and equity with interviews of Miami Foundation advisory committee members and experts in flood mitigation and adaptation research, policy, and planning. The resulting criteria were

- type of flooding exposure (coastal, riverine, storm surge, storm water, or a combination);
- project cost as a proxy for project size and significance;
- project funding source across the federal agencies and funding mix;

- geographic and demographic diversity;
- BCA value and component justifications; and
- other project requirements or components that might shed light on broader demographic diversity, equity, and inclusion efforts such as extended community engagement with vulnerable populations or discretionary assistance and waivers to serve households with low incomes or a marginalized community.

Because of interest among members of the Miami Foundation’s advisory committee, Urban also looked to the population of projects that might include “green” or environmentally restorative infrastructure components as these have also been the subject of recent conversations about the limitations of BCA analysis. Urban explored cases for which project details were publicly available or could be acquired within a reasonable time frame and with a reasonable amount of resources and for which there were identifiable individuals who could serve as respondents for interviews. This process resulted in the substitution of several projects that had been selected after the preliminary review. Ultimately, Urban identified five projects that met all the sampling criteria. Values against the criteria for the final purposive sample of cases are provided in table A.2 in the appendix.

Equity Dimensions

With the projects selected, Urban categorized for operational dimensions of equity that could be used to collect data from the projects and build the cases. The definitions rely on current social equity literature beyond infrastructure but with an eye toward practical application in infrastructure decisions.

- **Distributive equity** focuses on the proportional outcomes or impacts of an intervention both predictively and actually and the consequent disparate distribution of benefits, harms, exposures, and costs across populations (Martín and Lewis 2019; Svava and Brunet 2005; Taylor 2000). This dimension is typically the greatest concern for equity advocates but is the most resource-intensive and therefore the least measured. For example, flood infrastructure planners could either predictively estimate a project’s effects on different subgroups’ exposures in the affected region and attempt to minimize disparities or evaluate the impacts after the fact and correct the project to uphold distributive equity. Consequently, BCA would account for likely distributions of both benefits and costs between the groups and their cumulative values.

- **Procedural equity** references the processes and agents of decisionmaking, including the authentic engagement and empowerment of all stakeholders (Bullard 2005). This dimension also integrates transparency and representativeness (particularly overrepresentation of historically harmed communities in relation to the field of intervention) and seeks “social license” or approval (Dare, Schirmer, and Vanclay 2014). Infrastructure promoters and funders could, in theory, co-develop flood solutions with vulnerable groups, although, in practice, procedural equity typically devolves to tokenism and perfunctory input (Arnstein 1969). BCA is less material for this dimension of equity, apart from communicating its methods and findings.
- **Recognitional equity** addresses historical inequity. Most interventions are considered in light of their contemporary effects, but recognizing compounded disparities from past policies and discriminatory behaviors presumably leads to a different approach to procedural and distributive equity by the intervention agents in addressing the unequal group (McCauley et al. 2013). To uphold recognitional equity, infrastructure promoters might study the flooding variances between groups as well as their historical treatment after flood to engage in different engagement techniques with them and even develop alternative infrastructure approaches and designs. Benefit-cost analysis would have to weigh the added costs of thorough study and programming for ostensibly similar benefit.
- **Reparative equity** is fostered when interventions seek to explicitly and exclusively improve the conditions of a specific group within a population, such as households with low incomes (Palmer, McShane, and Sandler 2014). Most public safety net programs in the US model reparative equity approaches, although these rarely go beyond income eligibility requirements. Given the history of race-neutral and gender-neutral policymaking for flood infrastructure, the decision to advance a project that benefits solely one vulnerable group within a community or create a program to fund only those projects with that beneficiary group in mind fall under reparative equity approaches. BCA would integrate a wider and more accurate range of societal benefits that would result from a project’s positive improvements just for this group and costs from maintaining the status quo.

Data Collection and Analysis

Because there are effectively no projects for which quantitative estimates of equity were reviewed in the decision to fund or approve them for construction (or in evaluations after the fact), Urban sought a range of sources for qualitative information on the treatment of equity within each project.

DOCUMENT REVIEW

Urban collected, scanned, and coded project planning documents from each of the selected cases. Documents included recorded and publicly available BCAs, formal external communication about the project, environmental impact statements (EISs), community engagement–related documents, performance reports, and assessments. In total, from across the five projects, we reviewed seven BCAs, six project plans, four EISs, three community engagement–related documents, three formal communications, and two assessments. Table A.3 in the appendix details which types of documents we reviewed for each project.

INTERVIEWS

From December 2020 through March 2021, Urban conducted stakeholder interviews with representatives from five interview target groups: federal funder sponsors, state or local implementing agency representatives, BCA authors or consultants, community organization or advocate representatives, and local sponsor representatives. For each of the five cases, Urban researchers identified stakeholders in each category from project documents, online searches, and recommendations from other interviewees.

Protocols were designed for semistructured, 15- to 30-minute interviews and included baseline project background questions for all participants as well as suites of subquestions specific to their respective stakeholder group. Interview guides focused on the respondents' familiarity with the BCA process (e.g., the development, measures, and requirements for this specific project in question); whether projects incorporated or addressed any of the equity considerations defined for the study, either in the BCA calculation or otherwise (such as in community engagement activities); and whether the respondent had recommendations for improving BCAs in general and with regard to social equity in particular.

Most interviews were conducted one-on-one virtually and according to Urban Institute's Institutional Review Board requirements for human subject protections, including respondent confidentiality and consent and the security of the data they provide. The single exception to the individual interviews was one focus group with the implementing agency for the BIG U case, which included three city staff members. In total, 40 individuals across the projects were solicited for interviews, and 27 participated (see table A.4 in the appendix for a breakdown by project).

ANALYSIS

At the completion of the interviews, a coding schema was prepared to extract key themes by project type and equity definitions, as well as emergent subthemes. The document and interview data for each selected case were coded and analyzed to develop individual cases. These were subsequently drafted as stand-alone cases for this report. After each case's findings were drafted, cross-case comparisons were conducted with the same codes to develop patterns across the themes, the most consistent of which are summarized in the conclusion.

Urban researchers also overlaid policy analysis onto the cross-case comparisons based on the preliminary exploration of scholarly and practical literature. These insights allow for the presentation of researcher recommendations, which we supplement in this report with summaries of (1) the Miami Foundation advisory committee suite of policy and practice recommendations; and (2) suggestions from the case study respondents on practical strategies to improve social equity in federally funded flood mitigation infrastructure investments.

Study Limitations

The reader should take a few constraints into consideration. First, the projects were purposively selected and are not meant to be statistically representative of the population of contemporary federal flood-related investments. Though this limitation regarding the case study method is well-known, the researchers caution readers about generalizing from either the individual cases in relation to their respective federal funding agencies or from the cross-case comparison to the population of federal flood-related investments.

Second, despite including access to public data, documents, and willing respondents for interviews as selection criteria for the projects, Urban was often challenged in contacting representatives from federal, state, and local governments despite repeated attempts and an extended recruitment period. This challenge was particularly notable for the smallest of the selected projects, for which there was either limited information or interest in cooperating. Ultimately, these gaps necessitated the selection of alternative projects or the recruitment of enough additional respondents for the selected projects to satisfactorily triangulate information they provided and, in turn, build rigorous cases.

Third, the lines of questioning related to social equity likely introduced a social desirability bias among respondents that may have led them to overstate the equity considerations ascribed to specific projects. Further demand response biases may have been introduced because of the timing of the questions, in addition to their content: the interviews were conducted as the Biden administration

enacted executive actions related to environmental justice, racial equity, and regulatory review requirements. This context may also have shaped the researchers' bias as both the Miami Foundation and the Urban Institute are committed to social equity and removing the hurdles that prevent its manifestation in public policy. Pre-testing of protocols and reliance on scholarly evidence in designing the work and reviewing its findings help mitigate these possible biases.

Case Studies

Data were collected and analyzed for each project to build five distinct cases against the equity constructs. The findings related to each case are described through a consistent format below.

Miami-Dade Back Bay Coastal Resilience Plan

Challenge: Coastal, storm-surge flooding	Federal funder: US Army Corps of Engineers
Project size: \$4,586,000,000	Other partners: Environmental Protection Agency, Florida Department of Transportation, National Oceanic and Atmospheric Administration, and National Marine Fisheries Service
Cost share: 65 percent federal, 35 percent Miami-Dade County	Benefit-cost ratio: 9.4
Location: Miami-Dade County, Florida	Equity highlight: Environmental justice was an evaluation criterion for the project alternatives
Start year: 2018	
Status: Feasibility study completed; selected plan analysis expected 2021	

Case Selection

The selection of the Miami-Dade Back Bay Coastal Storm Risk Management Feasibility Study (CSRSM) as a case study was intentional, as the project represents large-scale infrastructure with estimated costs of \$4.6 billion, including storm-surge barriers, flood walls, and pump stations, as well as more discrete measures such as elevating residential buildings and floodproofing nonresidential buildings. The CSRSM also represents contemporary practices for the USACE, and the geographic area it intends to protect includes a diversity of vulnerabilities and demographics. The project is funded through a federal-local cost share, with USACE funding 65 percent and Miami-Dade County responsible for the remaining 35 percent. Finally, the CSRSM also included conscientious reference to social vulnerability as a determining factor in the project selection, though ultimately as a distinct project criterion and one mirrored in its BCA calculations.

Case Background

Climate change and sea level rise are exacerbating the risk of flooding across southeastern Florida, with a particularly high human and economic exposure to coastal storm and related flooding in densely

populated Miami-Dade County and its jurisdictions. Without a risk management plan, the low-lying region's exposure to coastal and inland flood damage from storm surge and sea level rise will grow.

CSRM was initiated by the state of Florida in 2018 with USACE's technical assistance and a study cost of \$3 million. Planning for the CSRM began on October 9, 2018, when Miami-Dade County signed the federal cost share agreement as the project's nonfederal sponsor, although the study itself was entirely federally funded. The county's Office of Resilience is the local sponsor, a function that carries the responsibility of briefing city departments and coordinating public comments. The project scope and objectives were discussed with the Tribal Historic Preservation Officer of the Seminole Tribe of Florida not long afterward, and USACE held a scoping meeting at the end of October. More stakeholders were involved the following month through a two-day planning charrette, which convened more than 70 institutional participants from the federal and local governments and local universities to review and identify options. A second planning charrette occurred in March 2019 to narrow these down.

The two meetings described as open house public meetings were a National Environmental Policy Act scoping meeting in December 2018 and a public meeting in September 2019. Once the HAZUS and social vulnerability index (SVI) focus areas were identified, potential storm risk management measures were determined. Measures were screened against project criteria, including reducing risks to health and human safety, avoiding or minimizing impacts to cultural and historical resources, decreasing vulnerability of critical infrastructure, and minimizing environmental impacts, among other flood risk mitigation goals. Eight alternative plans were developed from identified and screened measures to form viable packages of structural, nonstructural, critical infrastructure, and nature-based measures.

The study's eight project alternatives were compared across four dimensions: (1) national economic development, (2) environmental quality, (3) regional economic development, and (4) other social effects (USACE 2020). The last group had metrics for a range of social conditions, including human health, life safety, community cohesion, local and cultural identity, and recreational opportunities. The USACE also overlaid two review criteria related to its internal flood resilience strategies and an environmental justice assessment.¹⁷

After weighing the options and conducting BCA for each, a tentatively selected plan (TSP) was identified and released in January 2020. For the TSP, the two options with the highest social effect scores were selected, although it did not have the highest BCR (USACE 2020). The TSP's projects include up to two miles of floodwalls, pump stations, and storm-surge barriers to protect coastal populations and properties and reduce the impact and severity of inland flooding. The TSP also includes elevating approximately 2,700 structures and residential buildings. If it is implemented, USACE reports

that it will also reduce the number of households that would need to evacuate the region in the event of severe storms, thereby decreasing evacuation times for the region. The current TSP includes a single “green infrastructure” project of planting mangroves and native vegetation. Construction will not begin for another 5 to 10 years (USACE 2020).

In January 2020, representatives from Miami-Dade County and other government entities organized a multiday site visit that allowed a subset of stakeholders to better understand how different mitigation measures might affect the area. The visit included a boat tour along the proposed surge barrier and floodwall locations. The TSP was approved that month. The primary feasibility and impact reports were completed in May 2020. These detail the eight project alternatives within the identified geographic priority areas and include benefit-case considerations and criteria.

A public comment period lasted from June to August 2020. Community groups such as environmental nonprofits expressed disappointment at low levels of community engagement, which included two in-person meetings, one each in 2018 and 2019, and two virtual public meetings in June 2020.¹⁸ Ultimately, the signed chief’s report with final recommendations is expected in September 2021 (USACE 2020). The plan must then be approved by the OMB and the county.

Analysis

PROJECT BENEFITS AND TRADE-OFFS

Project documents and interviewees described the TSP’s benefits in relation to flood hazards alone: increased flood protection will reduce flood damages to critical infrastructure and homes and reduce evacuation times during emergencies. Other social benefits are less clear. Although the TSP gives some attention to identifying vulnerable populations for protection, the chosen project areas appear to have more economic value than other potential areas with socially vulnerable populations. Similarly, although some environmental justice priorities and considerations were included in a supplemental EIS, multiple interviewees perceived positive and equitable social impacts as secondary to protecting the built environment.

Because the plan purports to intrinsically benefit all area residents in some way, individual benefits are challenging to capture. Consequently, critics have focused on the timing of the receipt of benefits and on procedural gaps. They noted the project’s emphasis on avoiding damages to existing infrastructure and its proponents’ failure to incorporate community preferences for more green infrastructure elements, as well as overemphasis on gray infrastructure, specifically flood walls. Although gray infrastructure is designed to reduce storm-surge impacts and shorten evacuation times,

it can also inhibit waterfront access, depreciate landscape and waterfront viewsheds, and result in unwanted or unplanned environmental externalities. For example, proposed floodwalls and surge barriers could alter sediment deposition processes and disturb wildlife.

The TSP describes these impacts as minor. USACE reported that several natural and nature-based measures that were initially considered were eliminated because they were either already being implemented by other state or federal entities or because USACE planners foresaw potential limitations in material availability and anticipated a lack of cost-effectiveness.

BENEFICIARIES AND STAKEHOLDERS

USACE reports that the TSP will protect both coastal and inland residents; floodwalls near the coast and surge barriers at the Miami River, Little River, and Biscayne Canal are expected to not only benefit coastal dwellers but also prevent the overflow of the cities' inland canals (USACE 2020). Yet several interview participants felt the selected plan benefits higher-income communities most.

For example, one interview participant criticized the plan's recommendation to elevate homes in higher-income neighborhoods because they felt many residents could likely afford to pay for elevations themselves. Another interviewee described imbalances in the home elevation qualification criteria that may prioritize wealthier homeowners and more expensive homes over LMI homeowners such that a greater number of wealthier homeowners and more expensive homes can qualify. Multiple interviewees noted that because of racist housing valuations, such methods may result in white-owned residences receiving priority over those owned by residents of other races, even if the homes are physically comparable.

USACE staff and state agencies such as the Florida Department of Transportation, Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, and the National Marine Fisheries Service were involved in determining the siting locations and neighborhood priority areas. These agencies conducted initial scoping meetings and a two-day site visit to the project areas while project analysis was under way. While a City of Miami representative was involved from the planning stages as a city liaison between the city and the USACE, they reported that stakeholder group identification and prioritization was beyond the scope of their role. The project's feasibility report describes "any member of the public that might be able to affect, are affected by, or are interested in, the results of the Corps planning process" as a stakeholder, though only two of the meetings described in the TSP report were open to the public.

USACE used the SVI and FEMA’s HAZUS to determine social and economic conditions, respectively, resulting in seven geographic priority areas across Miami-Dade County. The SVI landscape was calculated using measures for area socioeconomic status, disability, minority status, language, and transportation, and the flood and social vulnerability data were overlaid to determine locations that had vulnerable populations and a high likelihood of economic damage. Social, cultural, and related community assets were outside the scope. Interviewees suggested that the data for economic losses were prioritized, resulting in project areas that did not exclusively target vulnerable populations, and that the resulting priority areas were drawn in a confusing manner. One interviewee said: “There was the intention, and they did explicitly overlay losses and SVI to select focus areas. You would just perhaps critique how it ended up.”

BENEFIT-COST ANALYSIS

The BCAs developed for the project alternatives were conducted by the USACE’s Jacksonville district using in-house modelling and valuation assumptions and techniques (USACE 2020). An independent reviewer evaluated the models, assumptions, and outputs to ensure they were realistic and in line with USACE funding priorities. The benefit-case inputs were typical of USACE-funded infrastructure projects and adhere to criteria for federal major investments in waterways. These prescribe considering the frequency of floods, damage, property claims, and lost lives versus project costs. No novel valuation techniques or measures were used in the economic analysis components.

Overall, benefit-case considerations for the project alternatives were economically determined and focused on monetizable measures, such as inundation reduction from flood protections, changes in property value from development in high-density areas, and reductions in emergency costs, including loss of life. The model was run using a sea-level change rate of 0.012 feet per year. The BCA’s emergency cost reduction included both evacuation and reoccupation. The report acknowledges that extreme weather events can have lasting and disproportionate negative socio-psychological impacts and that physical or socioeconomic conditions may make it more difficult for some populations to evacuate, but it does not quantify these extensively. An estimate of the people who do not evacuate in a hazard event is used to determine potential life loss, differentiated by age.

A BCR was calculated by dividing the average benefits by the average annual costs. The BCR needed to exceed 1, the minimum required for the justification of a USACE-funded federal project. Aside from the “no action” alternative, the BCRs for the proposed alternatives ranged from 2.5 to 14.8, and the BCR for the TSP was 9.4. USACE reports that the TSP was chosen because it had the highest net remaining benefits or produced the most benefits for every dollar of cost. It also tied for the higher

“other social effects” score, but this was not monetized. USACE further calculated a BCR for each subcomponent of project alternatives. All subprojects in the TSP had a BCR of 2 or greater, except for a proposed floodwall in the Edgewater neighborhood that had a BCR of 0.73. Although this was below the minimum requirement, the project was retained because the Edgewater floodwall may be needed for the storm-surge barrier and floodwall system in one of two Miami River project options to function properly.

Regarding the BCA, critical stakeholders argued that certain effects were missing or miscalculated in the BCA for the selected project. For example, the disruption or loss of recreation was not captured. However, the greatest source of concern appeared to be that factors were not proportionally calculated: one interviewee reported that the BCA did not place enough weight on benefits beyond preserved property values and wished for greater emphasis on lives protected relative to property values. They also observed that the BCA does not account for racial bias in property value discounting and that a fuller scope of real economic costs that result from disasters—such as the inability to get to work—are not considered.

COMMUNITY ENGAGEMENT AND COMMUNICATION

Multiple interviewees described community involvement in project identification and selection as limited. For example, one interviewee described a citizen oversight board made up of area community, civic, and foundation stakeholders as having “no teeth,” and that their input and oversight was perceived to be largely symbolic. Another interviewee noted that many components of planned infrastructure will affect large areas of the county but that most planning decisions are made at the USACE level: “There are lots of stakeholders in that sense, but at a certain stage in the process, only professionals are involved.” One interviewee said that no targeted outreach was conducted with affected communities and that no community groups were involved in project selection or prioritization. Another emphasized that USACE accommodated “a lot of extra meetings” to address public concerns but said that the average resident is likely unaware of planned project activities.

Public meetings were the primary method of community engagement. The City of Miami Beach participated in and helped coordinate public meetings, and interviewees reported that a couple of meetings were held in 2018 to solicit community input on where flooding was an issue. Interviewees reported that these meetings were primarily attended by county and city staff and had limited representation from area community groups and nongovernmental organizations. One stakeholder said that early community engagement centered primarily on industry or academic stakeholders and that

early design meetings were attended primarily by industry and academic stakeholders, with a few community and civic organization representatives present.

Some feedback was solicited before the finalization of the feasibility study, but interviewees reported that many community groups were not engaged until the feasibility study was published. One community group representative recalled that they did not become involved until a reporter reached out to them for a statement. As the feasibility study was under way, the Florida state archeologist contacted multiple Native American tribes, including the Seminole Tribe of Florida and Miccosukee Tribe of Indians of Florida, to submit comments, questions, or concerns regarding the study.

An open comment period for the feasibility study that ran from June 5, 2020, to August 19, 2020, was the primary channel for eliciting community feedback. Two or three events were held to solicit public input after the completion of the feasibility study; they were held virtually because of the COVID-19 pandemic. Multiple stakeholders reported that the timing of the public comment period was inopportune given the simultaneous occurrence of Black Lives Matter protests and the pandemic; they felt area residents had limited bandwidth to engage, and in-person meetings were not possible. Nonetheless, one respondent noted that “tons of groups” submitted comments. There is no evidence, however, that specific groups such as LMI residents or affected neighborhoods of color were intentionally solicited.

No public plan details how or by what processes individual project components, like home acquisitions and demolitions, would be conducted later. For example, 1,500 to 3,000 properties in the City of Miami Beach are expected to be affected by nonstructural project components, but interviewees reported that the city has not been told which properties will be affected. One commented that the city and most of its residents are “in the dark” about USACE’s plans.

Although neighborhood and civic groups representing some affected areas were active during public comment periods and community meetings, the representation varied and was largely self-driven. Overall, stakeholders reported that there was not a strong focus on receiving feedback from community members and that the level of community knowledge of planned activities is likely low. One stakeholder characterized the community engagement as “extremely weak” and “the bare minimum.” Another said, “The average resident on 10th Street doesn’t know that a wall will be constructed” through the neighborhood.

OTHER EQUITY CONSIDERATIONS

Respondents noted that the primary opportunities for addressing equity were distinct from the benefit-cost analysis. These included the environmental justice assessments as part of environmental impact, the discussion of social connectedness and social cohesion as part of the social effects review, and, most cited, the use of SVI in defining priority areas.

Although SVI was used during focus area prioritization, multiple project stakeholders felt the SVI measures were ultimately underweighted and that affluent populations received priority. One project stakeholder critiqued the process for prioritizing expected economic losses identified via HAZUS calculations over SVI populations, and another said the SVI calculations related more to physical vulnerability than social vulnerability. Consequently, several informants reported that areas they expected to be included in the project boundaries based on vulnerability-related criteria were not.

Findings

Three equity dimensions surfaced from this case. Distributive equity is omitted given that the information about the distribution of benefits and the burden of costs across the affected populations is insufficient and that the BCA does not attempt to estimate that disparity.

PROCEDURAL EQUITY

The most cited concern relates to procedural equity, particularly the limited engagement and communication efforts throughout the CSR and the resulting selection of the TSP. At present, no public plan exists to make community participation accessible for the most affected vulnerable populations in the long term, particularly amid the barriers to participation resulting from the COVID-19 pandemic. Nor does an open plan exist stating how individual project components, such as proposed home acquisition processes and priorities, may be communicated or negotiated.

There is also confusion about whether past and current comments have fallen on deaf ears. Although numerous community, civic, and environmental groups submitted comments on the feasibility study, USACE has given no discernible response to date, and no clear path exists for addressing the comments by the expected milestone. An interviewee reflected on past community meetings and feedback sessions they attended and noted that many community questions went unanswered in the published reports. Strategies employed by the county also appear to be limited, as interviewees report that the community oversight board's role is largely titular. Ultimately, one interviewee who works closely with USACE on the project said USACE does not "place much value on public comments."

RECOGNITIONAL EQUITY

Stakeholders raised three categories of concerns regarding USACE's efforts to define vulnerable populations. First, the opportunity to fully define vulnerability in both qualitative and quantitative ways was missed. USACE strictly used predetermined measures and data to identify vulnerable populations, and they may disproportionately undercount African American, Native American, and Hispanic/Latinx people (Elliott et al. 2019). If sources on the ground, such as community and neighborhood institutions with deep community knowledge and ties, were not engaged, an incomplete picture of vulnerability and, ultimately, the need for flood mitigation has been painted.

Second, many felt that USACE's HAZUS calculations reflected greater prioritization of physical vulnerabilities—such as capital stock losses because of physical damage to structures, contents, vehicles, and schools or income losses related to relocation or rental income—over the SVI-identified social vulnerabilities. Stakeholders reported that the consideration of losses predominated, and some socially vulnerable areas that have been and will likely continue to be affected by flooding were not included in project boundaries. Even with HAZUS calculations, stakeholders noted that secondary impacts—including job losses or relocation costs, as well as other social and cultural impacts—are not included in assumptions.

Third, the identification of specific populations and geographic areas using a combination of SVI and HAZUS should, in theory, have informed which projects were selected and the way they are communicated to the stakeholder communities—that is, recognizing who is vulnerable may yield innovations in how to address the vulnerability. The use of these tools suggests an interest in equity, which is encouraging. However, in the case of the Miami-Dade Back Bay Coastal Resilience Plan, recognition of socially vulnerable populations equated solely with counting them and considering those counts in project maps.

REPARATIVE EQUITY

The TSP is meant to address a regional need—that is, not the needs of a single group. The USACE storm-surge protection was designed to protect coastal and inland residents regardless of who they are or where they live. Stakeholders reported that the design intentionally did *not* target neighborhoods generally known to be socially vulnerable; one local sponsor representative said such a focus “would be unfair.” Likewise, documents do not indicate that the project intended to protect a single group. Instead, the project benefits are projected to be community-wide.

Consequently, project stakeholders were concerned that an agnostic approach to the definition of benefits could result in their uneven distribution. The selection of projects and processes could

ultimately favor higher-income residents and higher-value properties and exacerbate racial and income divides. One example referenced by many was the ongoing impact of racist housing practices on property valuations; they can result in greater financial supports for more affluent, white populations and properties that may need such supports less than LMI and other socially vulnerable populations do. Respondents feared that by not exclusively or even intentionally engaging the vulnerable populations, the project would result in the compounding of vulnerabilities.

Antelope Valley Redevelopment Project

Challenge: Riverine flood control, transportation, community revitalization

Project size: \$246 million

Location: Lincoln, Nebraska

Start year: 2004

Status: Completed

Cost share: Differs by project (35 to 50 percent nonfederal for flood control; 50 percent nonfederal for recreation)

Federal funder: US Army Corps of Engineers, US Department of Housing and Urban Development, and Federal Highway Administration

Other partners: City of Lincoln, Nebraska; University of Nebraska-Lincoln; and Lower Platte South Natural Resources District

Benefit-cost ratio: 1.3 for flood control; 1.8 for recreation; 1.3 overall

Equity components: Focus on people of color and historically underresourced neighborhoods

Case Selection

The Antelope Valley Redevelopment Project (AVRP) integrates flood control, transportation, and community revitalization improvements. It involved extensive community engagement planning and activities and prioritized historically marginalized populations, people of color, and refugees, making it an outlier among the projects surveyed for inclusion as a case study. Although federal entities required a BCA, the project developers also consulted market economists and transportation-sector stakeholders to consider qualitative costs and benefits beyond the federal BCA considerations. AVRP's funding comes from a unique mix of federal, public, and private sources. Federally, USACE, HUD, and the US Department of Transportation's Federal Highway Administration were involved. AVRP, then, is representative of both assisted flood infrastructure beyond the more likely federal agencies and the way these projects typically braid funding streams for successful completion.

Case Background

Riverine flooding from Antelope Creek has been a concern in Lincoln, Nebraska, since the early 1900s. After a major flood in 1908, the city attempted to both fill in the creek and contain the Salt Creek tributary in the Antelope Creek Box Conduit, a connected underground waterway. The conduit underwent significant repairs in 1993, which limited its capacity to carry storm water to no more than a four-year rainfall event. Overflow would affect the city's downtown, the nearby University of Nebraska-Lincoln campus, and the neighborhoods of color Woods Park, Malone, and Clinton in coming years.

Although flooding was the initial challenge that spurred AVRP development, it was inextricable from transportation and community revitalization challenges. In preparing for a transportation plan from the 1950s, the state Department of Transportation acquired properties and displaced residents in the mostly African American neighborhoods of Lincoln. The plan was never enacted, but the controversy led to mistrust that persisted for years. Multiple interviewees said that largely because of this earlier failed project, by the early 1990s, when the AVRP was in early planning stages, building trust with the community was identified as the primary project challenge. The AVRP was released one year after the Antelope Valley Redevelopment Blight and Substandard Determination Study found that commercial and residential buildings across eight urban core neighborhoods in downtown Lincoln were substandard and susceptible to serious flooding. Consequently, transportation, flood mitigation, and community revitalization were viewed as co-equal and mutually reinforcing goals.

The AVRP originated from the USACE's 1991 Antelope Valley Antelope Creek Reconnaissance Study. The City of Lincoln, the University of Nebraska-Lincoln Board of Regents, and the Lower Platte South Natural Resources District began working together in 1992 when they sponsored a USACE feasibility study and developed a joint problem statement—the "Antelope Creek Basin Development Plan Problem Statement"—for addressing flooding and transportation issues in the Antelope Creek Basin. The Antelope Creek Feasibility Study was sponsored by the group in March 1995, the same year it began contacting engineering firms to conduct a study. Following a January 1996 kickoff meeting that was structured as a two-day town hall and the adoption of a comprehensive plan, phased planning and progress reports were released.

The Antelope Valley Advisory Committee came together in June 1996, beginning four years of community engagement before the release of the Antelope Creek Draft Feasibility Report, which evaluated the economic feasibility of a proposed flood-control project. By April 2000, the project was sponsored locally by a consortium known as the Joint Antelope Valley Authority (JAVA), which included the city, the University of Nebraska-Lincoln, and the Lower Platte South Natural Resources District.

JAVA recognized that communities of color did not trust city leadership. Project activities, then, were intentionally designed to rebuild trust through extensive and long-term community outreach and consultation. A “draft single package” project plan for the three project components was vetted by the community before being presented to the City Council. More than 100 options were developed, including more than 50 storm water management concepts, 25 transportation concepts, and 30 community revitalization ideas. They were judged for “reasonableness,” as defined under the National Environmental Policy Act, and screened for avoidance of adverse impacts.

By October 2000, the USACE wrote that the project was “technically sound, economically justified, environmentally and socially acceptable.”¹⁹ JAVA authorized the implementation period for the first phase of AVRP projects in December 2001 and issued the first requests for construction services in May 2003. The project received preliminary USACE approval in 2000.²⁰ Funding for the project’s flood control component came from USACE, the Federal Highway Administration funded the transportation components, and grants were received from HUD for community revitalization components. Costs needed to be justified to each federal agency, but the only required BCA was for the USACE-funded flood-control project; it was calculated as part of the Antelope Valley Feasibility Study. Because the flood-control project’s BCR was greater than 1, the project was considered economically feasible and qualified for cost sharing with the federal government. Cost-effectiveness was used as a screening measure for the storm water and transportation components, but community revitalization interventions were screened for social and cultural factors instead.

In 2004, the plan was expanded and formalized into an urban redevelopment effort that included a “three-legged stool” of flood mitigation, transportation improvements, and community revitalization (City of Lincoln 2004). JAVA briefed elected officials on project progress approximately 35 times at various development milestones, and the city celebrated the completion of the most substantial project components in June 2012.

The project’s most distinctive physical feature is an open waterway that runs through the center of Lincoln, created through the restoration of the creek that once flowed there. The waterway was constructed as a linear park that confines a new 100-year floodplain within the channel banks, removing 600 square blocks along the Antelope Creek from the floodplain. Some homes and businesses were removed from the floodplain by property acquisition, but far fewer than were called for in previous plans. In addition to bridges built over the new channel, the waterway was complemented by a new boulevard; other roads were routed along the edges of residential neighborhoods to minimize acquisitions and neighborhood division. Other community amenities such as bike and pedestrian trails were also constructed. Collectively, these interventions incited a medical facility, recreational centers,

and grocery stores in the neighborhoods, and those in turn led to an increase in affordable housing and homeownership.

At completion in 2016 and substantially under the projected \$246 million budget, just 38 buildings, including three homes of significance in a historically African American neighborhood of Lincoln, had been relocated. Although the major project components were completed by 2012, JAVA did not disband until May 2016. The last amendment to the plan was posted in February 2017.

Analysis

PROJECT BENEFITS AND TRADE-OFFS

The AVRPP intentionally relocated vulnerable neighborhoods from the floodplain—preserving them, rather than dividing them. The transportation infrastructure also intentionally placed new arterial roads around neighborhoods, rather than through them. Interview participants noted a few additional benefits. For example, they reported that private sector developers benefited because larger swaths of land were removed from the floodplain, rather than patchwork or piecemeal parcels acquired throughout the city. One interviewee described the University of Nebraska-Lincoln as “the big winner” because much of its land adjacent to the newly constructed waterway was removed from the floodplain and a new road, new bridges, and new overpasses improved access to the campus. Interviewees also reported that the community benefited from new recreation trails and enhanced natural amenities along the riverfront.

Project stakeholders noted that trade-offs accompanied the project’s “three-legged stool” design but that the trade-offs strengthened the project’s overall impact. As they described, the flood, transportation, and community revitalization challenges were inextricable from one another. Planners initially began by assessing community transportation needs, but these could not be adequately addressed without prioritizing both flood mitigation and community revitalization. Interviewees also shared that the AVRPP had to meet the requirements of three separate federal funding agencies. Although the project may not have been the best possible stand-alone project for each, it was a balanced and successful project suited to Lincoln’s needs.

BENEFICIARIES AND STAKEHOLDERS

Throughout the project, the residents of the affected neighborhoods were viewed as the most critical beneficiary group. Though the city and institutional partners all benefited from the infrastructure's outcomes, the central purpose of the project was to ensure that these historically disenfranchised

residents would be at the center of the redevelopment, transportation amenities, and flood mitigation protections.

BENEFIT-COST ANALYSIS

Project stakeholders recalled that multiple BCAs were conducted, but only the BCA for the flood mitigation project components was required by USACE. The agency released the Antelope Creek Draft Feasibility Report in June 2000 with a project BCR of 1.23. USACE used in-house modeling and valuation assumptions and techniques to calculate a single BCR for the entire project floodplain area (Federal Highway Administration et al. 2001).

The USACE BCA did not assess distributive benefits or harms for specific populations, nor did it include other quantitative measures of social or environmental equity or community impact. The main category of benefits was the reduction in annual damages, calculated by averaging damages caused by potential storms of different severities. Also included as benefits were reductions in some indirect costs, including reduced business, traffic, and utilities interruption, as well as reduced loss of life. Separately, average annual recreational benefits were also calculated.

Others did quantitative and qualitative evaluations of project benefits. A transportation expert completed a BCA that evaluated the benefits of all three project components collectively. This stakeholder shared that one reason for the multiple analyses was that documentation showing the project was worthwhile was needed to secure different elected officials' support over the project's long timeline. The analysis found that for every public dollar spent, the community would receive \$7 to \$8 back in floodplain mitigation and social connectedness benefits. In addition to opening more of the city to investment and development, the project was designed so that if a flood occurred, amenities like medical care, groceries, and recreation could be back in use within a day. Other analyses showed that benefits would be spread across the entire Lincoln community, not just in the project area.

COMMUNITY ENGAGEMENT AND COMMUNICATION

Stakeholders attributed much of the project's success to its extensive community-engagement and trust-building efforts. A four-year period of community engagement preceded the release of the June 2000 draft feasibility study, and the City of Lincoln communicated widely about the draft plan's completion. In addition to posting the draft study on the city website, the rollout of the study included a series of public access television programs during the open comment period, four open houses, and guided bus tours for community members of the area where early phase projects were proposed. JAVA members identified additional municipal and grant funding for AVRPs community engagement

activities. Interviewees said that JAVA project leaders reached out to community groups to cultivate relationships, rather than waiting to be contacted by groups if and as problems arose.

Community leaders from market, state, and civil society groups were identified as important touchpoints for building trust, and emphasis was placed on developing rapport with them so they could advise and provide feedback on project plans and serve as liaisons between project planners and the broader community. One project stakeholder said significant efforts were made to involve residents of different neighborhoods as part of a “bottom-up approach” to ensure that project components would be viewed as valuable and beneficial to affected groups rather than as infrastructure and development activity that was simply “happening” to them.

One interviewee shared that, ultimately, about 13 organizations representing diverse community constituencies were involved in planning processes, and project documentation described planning participation from 16 leaders representing five community centers that serve Lincoln’s Hispanic/Latinx, African, African American, Asian, and Muslim residents. Project documents also described a community advisory committee made up of 65 people representing a mix of stakeholders that held regular meetings to provide community input. A managing subcommittee made major decisions on behalf of the advisory committee, but interviewees reported that their decisions were made by consensus and under the direction of the broader committee. Project decisionmaking was also informed by focused contributions from several working groups, including a work plan review committee, community revitalization team, and a town hall planning group. With guidance from the advisory committee, working groups, and community center representatives, JAVA project leadership identified Lincoln’s vulnerable populations in the project area as the key project stakeholders; those populations included people of color, people with low incomes, immigrants, refugees, and non-English speakers.

Multiple interviewees said more than 1,000 community meetings were held during the project planning periods to elicit community input, comments, and feedback, an engagement effort that one interviewee described as “extraordinary.” Weekly JAVA and working group meetings were held, and many were open to the public. The community meetings were hosted in neighborhoods throughout affected areas of Lincoln and at different times on both weekdays and weekends to accommodate residents’ schedules and ensure as many people as possible could attend.

Larger meetings included an annual town hall–style meeting at a multicultural high school that was centrally located to multiple affected neighborhoods. Meetings were also held at churches and other faith centers and community and civic centers. To ensure that residents who are often left out could engage and contribute to community meetings, translators were present, important documentary

materials were available in multiple languages, and free child care was provided. Interviewed stakeholders reported that in addition to ongoing ad hoc meetings with individuals and groups as needs arose, focused meetings were held with groups that would be most affected by either acquisitions or infrastructure siting plans.

Project planners made additional efforts to help community members understand the technical aspects of the project and stay informed of progress and plans. As part of a public information campaign in the early stages of planning, the city marked light posts along major neighborhood roads with flood height signage to help communicate the potential consequences of inaction.

JAVA leadership also communicated with community members and project stakeholders through media campaigns, including newsletters to more than 2,500 area residents, newspaper and radio advertisements and announcements, and local cable network programming and commercials. Project activities took place before the advent of social media, but stakeholders said that if the project had been more recent, they would have developed a robust social media presence and communications strategy. Planners also organized bus tours to similar sites in Kansas City, Missouri, so community members could experience how proposed infrastructure would look and feel. They also hosted periodic bus tours of the AVRPP project at key development milestones to showcase project progress and answer residents' questions.

Project planners emphasized written commitments or agreements as one approach to redressing historical failed promises. For example, to respond to concerns as they arose and elicit community consent throughout the project life cycle, JAVA leadership sought out community agreement at major project milestones, including by securing resolutions of support from 13 key community organizations that represented most affected residents. AVRPP leadership also hired a public engagement expert to facilitate and convene the public meetings and information campaigns throughout the project life cycle. Additionally, it hired a respected African American civic leader to advise and liaise between project leaders and African American residents in affected neighborhoods.

Despite efforts to make planning and public engagement activities available to non-English speakers, project leaders said they know some groups were left out. Stakeholders reported that when AVRPP was under way, Lincoln was among the top 10 refugee-receiving communities in the US, and more than 40 languages were spoken at many schools in the project neighborhoods. Even though project leadership worked to provide documents and translators in as many different languages as were needed, translation services were sometimes not available. Other times, they provided more translation

services than were needed. One stakeholder said translation was one area where they “didn’t hit it out of the park.”

OTHER EQUITY CONSIDERATIONS

Because of the federal funding, the project had several statutory requirements to identify social and economic impacts and minimize harm. For example, environmental impact assessments mandate that projects consider the potential social, economic, and environmental impacts, including those related to social and environmental justice issues. The project was also required to follow the Uniform Relocation Assistance and Real Property Acquisition Act, which dictates the minimum requirements and compensation for the acquisition of property or displacement. Beyond these requirements, however, project stakeholders strongly agreed that efforts to advance equity for historically underresourced and marginalized populations should exceed what was statutorily mandated.

Findings

REPARATIVE EQUITY

Project leaders were intentional about involving a wide variety of community stakeholders in decisionmaking, particularly those who had been displaced or were otherwise marginalized by previous infrastructure projects. When asked how JAVA seemed unified in a commitment to equity and neighborhood prioritization without formal or tacit requirements, one stakeholder said it was a matter of “having the right people on the bus.” Project leadership represented multiple local agencies, community groups, and perspectives and had deep community knowledge—particularly about past infrastructure challenges and the ways they disproportionately affected populations of color and low-income neighborhoods.

Although project plans and activities were not guided by codified equity goals or requirements, the recognition of and trust building with historically underresourced and communities of color reflect a dedication to social equity on the part of AVRPP planners. AVRPP and Lincoln leadership understood the failings of past infrastructure projects and invested the city, university, and state funding deemed necessary to not only avoid repeating those mistakes but also enhance social, economic, and natural amenities and improve residents’ quality of life in historically underresourced neighborhoods. To do so, AVRPP planners prioritized funding the community engagement and revitalization components of the project’s “three-legged stool” plan without a BCA. Project stakeholders understood that traditional BCAs can be inadequate tools to justify vital social and cultural investments, so they funded these activities locally and dedicated resources to securing grant funding to ensure they were prioritized

equally to flood and transportation infrastructure investments. In doing so, they applied a longer view to the project, prioritizing historically underresourced residents long before breaking ground.

RECOGNITIONAL EQUITY

AVRP plans were conceived and undertaken with Lincoln's legacy of marginalization of and disinvestment in communities of color during past infrastructure projects in mind. Interviewees reported that in prioritizing historically underresourced populations and by taking steps to meaningfully redress past failed commitments, not only did the project's flood mitigation and infrastructure components succeed but the quality of life of residents whose neighborhoods were protected was also improved. Understanding this community led to multiple project activities, including the highly tailored engagement campaigns.

Multiple interviewees described the intentionality of efforts like preserving historically important buildings in African American neighborhoods. Two respondents discussed deep community history and knowledge that was shared at meetings. As part of the effort, a trove of photographs that depicted neighborhood history was curated and displayed at the African American community center for all residents.

DISTRIBUTIVE EQUITY

Across interviews, project stakeholders focused little on the statutory or other formal project BCA requirements from federal funding agencies; instead, they emphasized the investments by JAVA and city leadership that went investments above and beyond what was statutorily required to respond to community needs. Project stakeholders said neither project plans nor BCAs explicitly articulated a dedication to equity because at the time of project planning, language around racial equity and social vulnerability was not commonly used in infrastructure projects. The project had no explicit requirement for participation or input from groups or stakeholders either. Yet, as one participant described, "the BCA is just dollars and cents—it isn't designed to address these other community things."

Despite the focus on the underresourced neighborhoods, project advocates still reaped benefits and minimized costs for the entire city and its major institutions. The range of studies and assessments that the project funders paid for independently were particularly instrument in envisioning the range of benefits and their distribution. These were not requirements of funding, but primarily central interests of the developers. Beyond the studies formally reviewed for this case, the researchers identified a now unavailable "professional economic report" that estimated that the project's benefits would exceed its costs by a 3 to 1 margin. The \$745 million in projected benefits included those not considered in the BCA, including \$63 million in time savings related to the construction of an overpass, \$242 million in

gains to the state and local economy attributed to the removal of the 100-year floodplain, and an additional \$229 million in “construction benefits.” In short, the project sponsors developed their own metrics for distributive equity and triangulated across these studies.

PROCEDURAL EQUITY

Equitable participation in project visioning, planning, and decisionmaking for the most affected Lincoln residents was foundational to AVR. JAVA worked with community members and leaders to ensure that processes and outcomes were not only acceptable but also actively consented to and perceived as beneficial by host neighborhoods both before the project’s initiation and during key phases.

Stakeholders reported that as important as beneficial outcomes were the processes by which they were realized, especially for those hosting development. Likewise, JAVA leadership’s treatment of securing community consent and support as an ongoing process, rather than a one-time activity before the ground breaking, made planners more responsive to residents’ feedback and increased community buy-in in project success, which one interviewee described as the “ultimate win-win.”

The BIG U/East Side Coastal Resiliency Project

Challenge: Coastal and storm surge flooding, sea level rise

Project size (East Side Coastal Resiliency Project): \$1.45 billion (including \$335 million via Rebuild by Design and \$176 million via National Disaster Resilience Competition)

Federal funder: US Department of Housing and Urban Development Community Development Block Grant Disaster Recovery Program (Rebuild by Design and National Disaster Resilience Competition)

Other funding: New York City

Location: Lower East Side, New York City

Population: 120,000 (28,000 NYC Housing Authority residents)

Start year: 2014

Status: East Side Coastal Resiliency Project began construction in November 2020

Benefit-cost ratio: 3.03 for BIG U; 2.84 for East Side Coastal Resiliency original (2017); 1.47 for East Side Coastal Resiliency approved (2019)

Equity highlight: Targeted areas with residents with low and moderate incomes and vulnerable populations; community engagement was a priority during Rebuild by Design competition; some nontraditional benefit categories were in the benefit-cost analysis

Case Selection

Among the case projects, the BIG U/East Side Coastal Resiliency (ESCR) Project in New York City is in the densest urban area. It also integrates built and social infrastructure approaches uniquely, partially

because of the constraints imposed by the design competition through which it received its HUD funding. Consequently, the project has included extensive community engagement, prioritization of procedural equity, and transparency for LMI households and neighborhoods of color. The project estimates a relatively high BCR and is currently under way.

Case Background

The BIG U was among seven winning submissions to HUD's 2014 Rebuild by Design competition, initiated in response to the devastation caused by Hurricane Sandy in 2012.²¹ Community engagement was required during the RBD proposal phase and occurred for the BIG U plan between November and March 2014. Engagement included two rounds of input and feedback solicitation from affected residents. In the first round of engagement, planners facilitated conversations with community members about their "ideal waterfront"; the second round involved soliciting feedback on two proposed designs.

The community feedback was integrated into BIG U proposals, which were subsequently presented to and discussed with community members again. The BIG U project team unveiled its final proposal to RBD in April 2014. Set in Lower Manhattan—home to 120,000 public housing residents threatened by future storms and sea level rise—the BIG U proposed reducing flood risk, improving access and connectedness between local communities and the waterfront, and enhancing public spaces in areas near public housing.²² The BIG U was among the competition's winners, which were announced in June 2014. At that point, the authority for project implementation transitioned to the city.

Multiple interviewees described the BIG U plan as still "just a concept." The winning BIG U design was broken into three "compartments" of infrastructure plans designed to provide a storm barrier to all of Lower Manhattan by forming a protective "U" shape around the southern portion of the island.²³ The first of three projects was rebranded as the East Side Coastal Resiliency Project and is currently under way. ESCR includes the redevelopment of East River Park, with improved bridges and new entry points to make the park more accessible to the community, and the installation of floodwalls, a protective berm, and storm barriers.²⁴ A BCA for the initial ESCR plan, which aligned closely with the original BIG U design, was completed in February 2017, with a BCR of 2.05. HUD awarded \$335 million for ESCR implementation; to cover the total cost, New York City provided additional funding.

The city initially moved forward with the plan from the winning proposal largely intact. However, officials stalled the project in 2018 for about four months to incorporate a significant change: elevating the entire 58-acre park by 8 to 9 feet.²⁵ Rather than allowing for periodic flooding, as in the original plan,

the new plan eliminates tidal flooding while creating an entirely new park. An estimated reduction in construction time of 1.5 years was also touted, but some stakeholders saw it as the city prioritizing reduced traffic disruption on FDR Drive. One stakeholder shared that project planners and community members were at the point of selecting benches for the park when the city stopped communication entirely, and the plan to elevate East River Park was announced in September 2018. The new plan was approved by the city council in November 2019. Although the changes have created tension and mistrust between the city, project planners, and community and neighborhood groups, the new plan is under development and includes an additional investment of \$1.2 billion from the city to pay for the revised estimate of \$1.45 billion.

In both designs, the investment in neighborhoods of LMI households and large public housing stocks is a departure from past infrastructure projects. The city formed a community advisory group to oversee the project for the duration of construction. The Pratt Center for Community Development was tapped as its facilitator to liaise with construction planners and affected neighborhoods. The first advisory group meeting was on June 17, 2020. Construction on ESCR broke ground in November 2020, with the elevation of East River Park expected to begin in spring 2021.

Analysis

PROJECT BENEFITS AND TRADE-OFFS

The ESCR will provide flood mitigation for LMI neighborhoods on the Lower East Side, protect a park that will be accessible to those living in affordable and public housing, and provide accommodation for traffic (New York City Mayor's Office of Management and Budget 2019). Currently, the park is not easily accessible to LMI populations and the broader community in Lower Manhattan because FDR Drive is a barrier between the neighborhood and the park. The new project offers reconstructed bridges and more entry points to the park to improve accessibility, and the combination of elevated parkland, floodwalls, berms, and an upgraded sewer system will improve storm water management and prevent flooding in a diverse neighborhood. Some stakeholders noted that shorter proposed construction times have transportation benefits in the form of less traffic congestion on FDR Drive.

Multiple stakeholders pointed to procedural trade-offs related to starting the planning process with a community-based visioning process versus beginning the process with a more intentional focus on technical feasibility. The RBD competition allowed designers to hear from community members who are not often engaged in traditional infrastructure projects, and one stakeholder noted that community members helped shape some of the unique design and social components that were integrated into final

plans. A different stakeholder credited the RBD competition with building social engagement processes into project and design requirements. Yet one of the stakeholders who praised the competition's community engagement integration also suggested there was some disconnect between the RBD vision and the reality of later project implementation, such that community members needed to understand that the original plans and visioning processes were more abstract than concrete. As one interviewee said, "those proposals were just ideas."

City stakeholders involved in implementing ESCR also identified this apparent disconnect as a challenge, explaining that the projects the city inherited from the RBD competition were not technically feasible and that the competition did not adequately emphasize attention to technical, operational, or regulatory constraints. Although all stakeholders agreed that the communication of technical project requirements could have been better facilitated, finalizing a feasible plan within the timeline set by federal expenditure deadlines was in tension with honoring the input and maintaining the trust of the community. Balancing these tensions was described as a central project trade-off, which many stakeholder interviewees said was not managed well.

BENEFICIARIES AND STAKEHOLDERS

Project stakeholders include federal entities, multiple New York City offices and agencies, nonprofits, environmental interest groups, and affected residents, including people who live in public housing, LMI households, and older adults. If completed as planned, the projects that stemmed from the RBD competition stand to benefit the 120,000 LMI residents within Lower Manhattan, in addition to all area residents and property owners. The ESCR alone is purported to protect 28,000 residents living in New York City public housing from flood risks.²⁶ Neighborhood residents will also benefit from park amenities and avoided damages.

As the entity responsible for implementation, New York City is a central stakeholder in the suite of projects that developed from BIG U designs. Once the winning RBD proposals were selected, New York City inherited the winning BIG U plan and vision but had the authority to move specific concepts forward. Staff from the New York City Department of Parks and Recreation, the Mayor's Office of Resiliency, New York City Department of Transportation, and the New York City Department of Design and Construction have been integral as the new project plans have unfolded. Design firms involved with the RBD competition also had a central role in early community engagement and stakeholder identification.

Ultimately, a central debate is whether the city's changes to the plan were justified for the purported beneficiaries. The original plan would have allowed the park to flood, and more than half the

trees would likely have eventually died from salt water intrusion. The new plan raises the park by burying the old one, meaning that mature trees will be destroyed. Stakeholders who favor raising the park argue that doing so will protect it, will make it accessible long term to those living in affordable housing, and will avoid future costs of repair if the East River overflows. The new plan also allows for phased construction so some park space is always open for residents. The phased construction further provides accommodation for traffic along FDR Drive, which some neighborhood stakeholders view as a benefit to commuters at the expense of residents. Another issue raised by multiple stakeholders was the project cost. The new plan is more costly than the original—an investment that one stakeholder characterized as “critical” and “historic” and that others criticized.²⁷

BENEFIT-COST ANALYSIS

Benefit-cost analyses were used to envision, propose, and approve the project throughout its development, beginning with the RBD competition phase. A project stakeholder who was part of the BCA development team for the initial BIG U proposal shared that adhering to federal guidelines during the competition was imperative; a BCA of more than 1 was expected. The interviewee reported that at these early stages, they estimated general, traditional costs and benefits based on rough square footage and dollar amounts, and no novel valuation techniques or measures were used. One interviewee involved in judging project submissions said the BCA was a required document during application phases because “it felt like you had to.”

Multiple interviewees involved in the RBD competition reported that BCA requirements were relatively flexible in part because the large size of the Lower Manhattan floodplain and the high values of the properties on it meant that achieving a BCA greater than 1 was not a challenge. Potential flood damages were “enormous,” as one project stakeholder said, and the avoided costs of direct replacement and displacement for “nearly any project” that reduced flood damages would be “huge.” A stakeholder involved with the BIG U BCA calculations reported that during the competition phase, the team could have made the BCR “whatever we wanted it be to be” because virtually any metric and valuation combination would achieve the 1+ ratio. In fact, even though the analysis team studied numerous options and scenarios, they reported, both the costs and benefits used were still likely underestimated. One reported advantage of not needing to adhere to statutory BCA requirements was that different cost inputs could be used for different neighborhoods, a practice that is not typical, according to interviewees.

When the winning project concepts developed during the RBD competition were transmitted to the city to implement, the city contracted with the engineering firm Arcadis to conduct BCAs for various

components of the ESCR plan. The analyses, completed in February 2017, assessed project benefits and costs over a 50-year life span. Methodologies for the BCAs were from multiple federal funders, including EPA, FEMA, USACE, and the Federal Aviation Administration, as well as other published sources. Benefits were categorized by either losses avoided or added values, with the former being the largest and including displacement, increased travel time, and business interruption, in addition to avoided costs related to mental stress, anxiety, and lost productivity.

Although some measures of losses avoided were beyond what is traditionally required, the added value categories were even more expansive. For example, benefits provided by natural vegetation—such as adding green space and planting trees—to area water quality, air quality, and climate regulation were all calculated and included in the final BCR. Benefits to property owners, such as increased property values and a reduction in flood insurance premiums, were also calculated. Lastly, social benefits from recreational and community space were estimated using willingness to pay values.

When New York City moved forward with the elevated park plan, a new BCA was conducted in 2019. Also authored by Arcadis, the new BCA documentation specifies that it was prepared in accordance with the project's HUD funding requirements and did not include supplemental project components that were outside the scope of HUD's requirements (Arcadis 2019). It included the same benefits categories as the 2017 BCA, with the addition of avoided damage to park facilities. The updated BCA stipulates that the ESCR will reduce flooding for 1,082 buildings and will benefit an estimated 91,000 people and nearly 300,000 workers, although it does not include additional socio-demographic details or specificity regarding the types of structures to be protected.

Regardless, interviewees agreed that none of the project's BCA iterations fully captured the scope of benefits or costs. Although the project BCAs included some social and environmental measures, one stakeholder reflected that other such measures need not have been excluded simply because they could not be easily measured considering that "objective" valuation measures are not perfect. Another stakeholder involved in the 2019 BCA suggested that a framework shift is needed to adequately portray the disproportionate impacts of climate change.

The 2017 BCA for the ESCR plan that was closely aligned with the RBD design projected \$1.9 billion in benefits from a planned investment of \$702 million, for a 2.84 project BCR. The total resilience, social, economic, and environmental benefits calculated for the new project's 2019 BCA were \$2.1 billion, including a planned investment of \$1.45 billion, for a BCR of 1.47. Overall, the project being implemented has a lower BCR, and the city has committed significantly more funding as a result.

Ultimately, neither the conceptual RBD BCA nor the 2017 and updated 2019 ESCR BCAs categorized benefits by distribution across population groups. One interviewee lamented this, noting that property owners will certainly benefit more than renters, but also reflected that BCAs are not designed to address issues of distributive benefits or burdens. Projects were judged on their budget, design, and community engagement initiatives because the HUD requirement to prioritize low-income populations in the project area was already the central mandate.

COMMUNITY ENGAGEMENT AND COMMUNICATION

Entries to the RBD competition were evaluated on their community engagement plans, which were required to be iterative, with built-in milestones for design teams to incorporate community feedback, respond with updates, and resolicit feedback (Martín et al. 2014). In planning its engagement activities, the BIG U project team reviewed previous area projects to understand what was important to the community and identify community engagement activities that could work well. Interviewees described as substantial the community involvement and project communication throughout the planning phases and up until the city changed the project. For example, RBD sought the initial meeting with the Lower East Side Long Term Recovery Group (LES Ready), a coalition of neighborhood organizations that came together after Hurricane Sandy and went on to play a central role in facilitating communication with community groups during the design process.

In the design phase, BIG U planners developed a detailed stakeholder map and conducted 16 weeks of outreach in locations across affected neighborhoods.²⁸ During this period, a diverse group of community leaders from civic and nonprofit organizations was identified for engagement. Project planners also reported that from the beginning of project planning, community members—including residents of public housing, people of color, and older adults—were targeted for involvement. A civic leader in a neighborhood near the project location described the BIG U team’s involvement with the community as “very early” and said the team was “open to connecting with anyone in the community” who wished to be involved. City stakeholders likewise described early community engagement activities as strong.

One stakeholder described the team’s community engagement as “awesome,” detailing the processes for incorporating public feedback into the project design. The first round of community engagement included community visioning meetings to solicit residents’ perceptions of “ideal waterfronts.” During the second round, feedback was incorporated into two design solutions that were presented to community members for feedback and discussion. Community members’ comments were

further integrated into the plan, which was finalized and presented again for final review and discussion before being submitted to RBD.

To connect with residents who may not have been able to attend the community visioning and feedback meetings, additional outreach was conducted through flyers, mailers, and door-to-door engagement in each area slated to host a project component. Project planners also found that attendance at public meetings increased significantly when transportation was provided, so they made that part of later meetings. Beyond the BIG U design team, interviewees reported that RBD was also involved in early community engagement activities. For example, RBD hosted periodic luncheons with community board members to update them on project design activities, answer questions, and solicit feedback. One community member said, “RBD wanted to make sure they had good community engagement and that everyone had a voice, so they let us lead.”

When the RBD design and award phase concluded and BIG U project plans were passed to the city to facilitate project development, one stakeholder said, “community engagement continued to be important, but there were heavy considerations towards balancing community input with city agency input.” During this period, the city hosted large public meetings and smaller, more local meetings dedicated to specific community concerns or project issues. Some meetings were held on public housing campuses to make attending more convenient for residents; city stakeholders described this approach as “meeting people where they are.” Community meetings included translation for a few of the languages spoken by residents.

However, some interviewees said community engagement issues arose around when the project was handed off to the city, even before the significant project changes were announced. One challenge was disruption to project continuity and public communication, which multiple interviewees described as likely unavoidable given that the project was conceived and designed by one party and implemented and managed by another. For example, interviewees reported that the groups involved in engaging the community after the city took over the project were different from those involved during the competition phases, and community boards did not become seriously involved until the city took over. Meanwhile, some community organizations and civic groups that were engaged in the competition period were not after the project transitioned to the city. One member of a community group shared that organizations previously involved in community engagement had to work with the city’s preselected contractors if they wanted to be selected to support community engagement efforts once the city took over, a change in protocol that they said was not made clear to the organizations.

A loss of trust and planning fatigue created challenges to public acceptance of the city’s new plan. One interviewee described this time as one of “radio silence” from the city. Community stakeholders

reported that community groups were not consulted on changing the plan before the announcement. In addition to a loss of trust, a lack of clarity on the details of the project changes was a central theme mentioned by stakeholders. Community groups had to look to experts to explain the technicalities of the new plan and did not necessarily have the time or expertise to process the volume of new information, which was presented with less explanation than the earlier plan that the community groups had approved.

As planning neared completion and the city prepared to break ground on the new ESCR design, community engagement further declined. Although ESCR project documentation designates fall 2018 to spring 2019 as a period of “interactive community engagement,” interviewees shared that after the project changes were announced in September 2018, communications were minimal. One community member who was involved in earlier planning said conversations with the city that were initially open to anyone became more exclusive, and community board members who were interviewed reported finding themselves in the difficult position of acting as the main liaison between the city and discontented community groups.

OTHER EQUITY CONSIDERATIONS

An RBD stakeholder emphasized that even though distributive and procedural equity considerations were not required in the original BIG U BCA, equity was addressed via the RBD and HUD’s statutory requirement that the projects benefit LMI populations. This interviewee reported that winning designs “tried to be comprehensive” in their consideration of social equity from the outset. A project stakeholder in the original BIG U design said that neighborhoods like the Financial District were not considered during project planning in part because of HUD’s requirement, such that areas with higher-income residents and higher-value properties were “not in [HUD’s] purview.” Selecting a location like the Lower East Side with a sizable LMI population was described as easy because it was a project requirement to prioritize LMI areas. Designers participating in the RBD competition also recognized that the East Side waterfront had not benefited from the same investments as the West Side, so plans were designed to increase equity in waterfront access for residents who have low incomes and live closest to the project sites.

As another measure to ensure physically and socially vulnerable populations benefited from RBD proposals, projects were evaluated on their proposed impacts to community and neighborhood resilience, connectedness, and social infrastructure in planned goals, outputs, and outcomes. Multiple interviewees were skeptical that these impacts were achieved, however, even though their inclusion, at least conceptually, was required by RBD. In practice, one interviewee described the project’s overall “social goals” and related project requirements as “generally nebulous,” such that even though

considering social equity was evidently vital for project consideration during the competition phase, no statutory requirement or guidance existed for operationalizing and evaluating the social equity components that were included. Discussing the same issue, another interviewee who worked on the original BCA team noted that project goals to enhance neighborhood and community resilience “just did not show up in the numbers.”

Several stakeholders referenced the project’s later EIS as including the most detailed analysis of social benefits and environmental justice considerations; it concluded that residents of color and residents with low incomes would not experience disproportionately high or adverse environmental or human health effects (New York City Mayor’s Office of Management and Budget 2019). Equivalent distributive measures were not included or evaluated in the final project BCA.

Findings

Though conceivably the most quantifiable, distributive equity is the most ambiguous of all equity dimensions in this case. Neither the original BCA nor its many iterations tried to measure the project’s distributive effects on benefits and costs, partly because of the underlying assumption that the funder’s focus on LMI households had already accomplished this goal.

REPARATIVE EQUITY

For the BIG U project, equity was considered a precursor to planning and consideration of costs and benefits because of HUD’s statutory requirement to prioritize LMI populations, such that RBD competition entrants were required to select areas with low-income populations for project development. Likewise, evaluation criteria for the RBD competition phase required that social equity factors beyond property losses be considered; proposals were judged on their inclusion of resilience, connectedness, and social infrastructure components. RBD wanted to see evidence in planning that project impacts would benefit physically and socially vulnerable populations the most. Project stakeholders involved at various stages of the BIG U plan reported that these requirements were well-publicized and understood, such that competition teams worked from the start to prioritize social equity. The revised ESCR project is consistent with the original plan in its prioritization of areas where people with low incomes and communities of color live, including areas with large populations of public housing residents and older adults.

Even so, project, city, and community interviewees were mixed in their perceptions of the project’s authentic reparative equity. Although stakeholders agreed that the statutory requirement to work in areas with high numbers of LMI households was vital to ensuring that historically underresourced

neighborhoods would benefit from the project, interviewees involved in the design phases agreed that the extent to which equity measures like resilience, connectedness, and social infrastructure will result from the project and will be exclusively to their benefit is questionable. Interviewees said that this is because the requirement was more conceptual than empirical and that no measurement or evaluative component to assess the impact or success of social equity priorities was included for many of the planned designs and activities. Emphasis on the prioritization of social equity was robust during the project visioning and design phases, but project stakeholders reported that critical project components to make the equity plans and visions actionable—such as requirements for measurement operationalization either within or apart from the projects' BCAs—were missing.

RECOGNITIONAL EQUITY

The early focus on procedural equity through extensive community engagement was thought to be beneficial for implementing strategies to engage vulnerable communities and better understand their needs for communications and the resulting infrastructure designs. However, the transition to implementation and its more exclusionary approaches to considering the community's needs present a nuanced shift.

Although interviewees described the reduction in the city's engagement as effectively shutting out many of the community members whom the project was purported to prioritize, the new plan was not ultimately one that the community would reject. Neighborhood and project stakeholders said that when the new plan was announced, the most vocal opposition was from a relatively small group of environmentalists who objected to the new plan's effects on trees in the park. The stakeholders said that this group was not representative of most of the people with low incomes and people of color in affected neighborhoods and that many of the group's members did not live in the area. A stakeholder from a community-based organization shared that while the "white gardener and environmental folks" were able to amplify their voices, this resident felt that they did not have the time or access to weigh the costs and benefits of the new plan for themselves and that this was the case for many area residents.

PROCEDURAL EQUITY

Requirements to advance procedural equity were integrated into RBD competition criteria, and engagement with and feedback from affected residents were described as robust during design visioning and planning stages. However, the transition to the city's revised plan and the communication and engagement that followed the announcement were a marked weakness in procedural equity, such that contact with residents for solicitation of input and feedback virtually stopped.

All interviewees noted significant inconsistencies and gaps in communication over the project life cycle, in large part attributed to the unique competition-based and public-private model of the original HUD/RBD program and the subsequent transition to the city for implementation. City representatives described fatal gaps in the original plan’s attention to project feasibility as necessitating this transition. All respondents agreed, however, that when the city took over the project, it did a poor job of communicating its feasibility concerns and alternative solutions to the public, resulting in a significant loss of community trust in planners and the city, as well as sense of community stakeholderhood in the new plan.

Some stakeholders were critical of the city for the way the change to the project was communicated, although not for the change itself. In fact, a few stakeholders who heavily criticized the city’s poor communication thought the new project was the better option. One community representative felt that city leaders wanted to “put their mark on the project,” which they said accounted for the project rebranding. In combination with inconsistent and poor communication practices, they felt this further harmed and confused public perceptions of the project. The overall limitations to continued investment in engagement for a project of this scale have taken their toll. Two interviewees said they observed community attrition because of declining engagement from the city and project planners, such that “fewer and fewer people are paying attention anymore.”

Ohio Creek Watershed Project

Challenge: Coastal, storm-water, and storm-surge flooding

Project funding: \$130 million grant; \$69.2 million direct leverage; \$70.9 million supporting leverage for resiliency

Federal funder: US Department of Housing and Urban Development Community Development Block Grant Disaster Recovery Program

Other partners: State of Virginia, City of Norfolk, and private organizations

Location: Norfolk, Virginia

Start year: 2016

Status: Under construction

Benefit-cost ratio: 1.06–2.03

Equity components: Neighborhoods with households that have low and moderate incomes and people of color were prioritized; extensive qualitative considerations in BCA

Case Selection

Among the case projects, the Ohio Creek Watershed Project (OCWP) is moderately sized \$130 million. Its BCA explicitly includes social, cultural, and environmental measures, reflecting the requirements of its HUD funding, which, like the BIG U/ESCR, involved CDBG-DR funds awarded through the National

Disaster Resilience Competition. LMI neighborhoods of color were prioritized at the beginning of the project. The City of Norfolk, Virginia, identified the Grandy Village and Chesterfield Heights neighborhoods, both with majority African American residents, as target development areas. Its overall BCR is relatively low compared with the other cases, further justifying exploration.

Case Background

Located on the shores of the Elizabeth River, the Grandy Village and Chesterfield Heights neighborhoods of Norfolk, Virginia, are susceptible to tidal flooding during heavy rain and coastal storm events. The capacity of Norfolk's storm water drainage system is exceeded during hurricanes, nor'easters, and even heavy rain events. During even minor events, high tides cause the river's waters to flow in reverse, flooding the storm water system and the Grandy Village and Chesterfield Heights neighborhoods. The OCWP is intended to address chronic flooding events in these two vulnerable neighborhoods.

The relationship between flooding and vulnerable populations in Norfolk was a concern that predated OCWP planning. In 2013, the Norfolk Mayor's Commission on Poverty Reduction identified flooding in high-poverty neighborhoods as a critical issue, and projects like OCWP have been proposed since. In 2014, HUD's launch of the NDRC prompted an application from Virginia for flood resilience infrastructure development and planning, with the cities of Norfolk, Chesapeake, and Newport News as subapplicants. Community engagement activities have taken place throughout the project's inception, planning, and ongoing implementation phases (Hampton Roads Planning District Commission 2015).

Winning proposals were announced in January 2016. After Virginia received funds, a subrecipient agreement with the City of Norfolk was finalized in March 2017. About 25 public workshops and outreach meetings were held between May 2016 and January 2018 to help clarify the project's purpose and develop the four alternatives included in the draft EIS. Meetings included planning workshops, design charrettes, amenities workshops, and public forums. Meetings were attended by residents of both Grandy Village and Chesterfield Heights, as well as representatives from civic groups and schools.

When Virginia was awarded the \$112 million grant from HUD, it allocated the funds to the OCWP and a few other projects.²⁹ The OCWP proposal was developed as part of the Norfolk Coastal Adaptation and Community Transformation Plan, a proposal to build water management solutions, strengthen vulnerable neighborhoods, and improve economic vitality. The OCWP aims to both protect residential housing from nuisance flooding and future coastal inundation while improving neighborhood connectivity and natural habitats. Permit drawings were completed in winter 2018, followed by the

completion of bid packages for construction in early 2019. The project is under construction, with some components completed as of the most recent project update, in January 2021 (City of Norfolk Office of Resilience 2021). Completed components include nearly half the living shoreline, berm areas, storm water pump stations, and tidal gates. New playground equipment has been installed at the public school in the project area, and work to update storm water pipelines and to expand wetlands continues. Construction is slated for completion by early 2023.³⁰

The project includes shoreline protection in the form of 3,000 linear feet of elevated roads, a 5,000-linear-foot coastal berm, a 2,100-linear-foot floodwall, and eight tide control devices at five riverine locations. Gray and green infrastructure designs are combined through a berm and wall shoreline protection system, which is complemented by living shorelines that, in addition to enhancing shoreline stability, are expected to expand species habitats. The project features storm water interventions as well, including retrofitting streets with pervious pavement and installing bioswales and dispersed, parcel-level storm water collection systems—such as rain gardens and rain barrels—to ease the strain on the city’s infrastructure. The expanded park space and wetlands will hold storm water and provide natural storm water filtration. These components, in combination with the new tidal gates and check valves, will enhance area marshes’ resilience and capacity to absorb riverine flowback and tidal rise during flood and storm events.

The project also features community amenities such as recreational areas, bike lanes, sidewalk connections, and pedestrian walkways, and a new Resilience Park is being developed as a community open space with multiuse sports fields and community gathering space that complements the flood berm, restored tidal creek, and wetlands. The city is acquiring 15 properties, 5 currently occupied, in Chesterfield Heights from willing sellers as the project enters the construction phase.

Analysis

PROJECT BENEFITS AND TRADE-OFFS

The OCWP is designed to reduce nuisance and storm-related coastal and riverine flooding and to enhance natural and public amenities in a low-income and historically underserved area of Norfolk. Project proponents expect property values to increase, and children will have safe places for recreation and outdoor learning. Project proponents also say that new transportation and flood protection infrastructure will help better connect the Chesterfield Heights and Grandy Village neighborhoods to the city, as the communities were spatially, socially, and economically isolated by Interstate 264. It will also provide improved resident mobility in and out of the project area during extreme rainfall and storm

events because a planned road relocation will reduce the frequency of flooding caused by wave action and tide surges, and coastal measures will protect other existing roads. Planners say developing additional transportation routes into the neighborhood and removing area lands from the floodplain will encourage business and economic development, which will expand services and amenities to residents and strengthen the neighborhood economy.

However, development will require three years of construction disruptions, a fact that one stakeholder felt had not been communicated well. For example, one road being raised will be closed for two years, and although the city has constructed a temporary alternative route, some community stakeholders were unclear on the closure timeline and reopening plans. Interviewees also reported trade-offs between property acquisitions and protective infrastructure connectivity. To build a continuous living shoreline and berm, some properties were acquired that could not otherwise be logistically or structurally accommodated. Although buyouts were voluntary, three acquired homes were occupied by renters. The city did not want to force any relocation, so it approached the tenants to see whether they were willing to relocate. As of January 2021, the city was working with the tenants to find them new housing, a process that one city stakeholder described as “a long hand-holding” with paperwork that is “involved and complicated.” Another interviewee shared that homeowners received fair market prices and sometimes negotiated for more, and project documentation reports that funds were allocated to pay for moving and living expenses. However, one project stakeholder noted that even though relocations were voluntary and the expenses were paid, some residents who participated may still have preferred not to go through the process.

Another project trade-off to connect the living shoreline and shoreline berm involved placing easements on parts of some residents' backyards. A total of 47 temporary or permanent easements were planned to allow for utility installations, floodwall or earthen berm construction, wetland creation and grading, and other construction activities, resulting in the loss of property for some and new land right restrictions for others.

BENEFICIARIES AND STAKEHOLDERS

By HUD requirement, the OCWP will protect low-lying areas of Norfolk where sizable groups of people with low incomes and people of color live. Most of the housing to be protected meets the state's LMI requirements: the new shoreline system will protect approximately 450 residences occupied by LMI households, including a public housing community with more than 300 units. The median household income in the project area is \$28,600, which is significantly lower than Norfolk's median of \$44,500, and

93.5 percent of the population of the census tract that will be most affected by the project is people of color.

The project will also protect critical public assets, including a public school and two community centers. Interviewees reported that special consideration was given to how the project would protect and improve property values for the area's residents of color and LMI households, most of whom are homeowners. Public housing residents were also considered; they will benefit from the increase in flood protection and access to public and natural spaces.

Although the OCWP targets two neighborhoods in Norfolk, project planners have been mindful of its connection to broader integrated water management goals for the city and the region. The project management team is made up of City of Norfolk staff from the Office of Resilience and the Public Works and Finance Departments, with consultants from CB&I, HR&A, Arcadis, and VHB. In addition to leading project activities, this team worked with neighboring cities to determine how the project fits into regional resilience planning goals and to rethink zoning, which has neighborhood or regional implications but is controlled at the city level.

Interviewees reported that OCWP's primary funder, HUD, has a stake in ensuring that projects funded through the NDRC successfully respond to disaster threats and prioritize LMI populations. Other primary partner agencies include the Norfolk Redevelopment and Housing Authority, the Elizabeth River Project, and several area universities.

BENEFIT-COST ANALYSIS

The project BCA was prepared by the City of Norfolk in consultation with Arcadis (Arcadis 2015). HUD specified that the NDRC competition BCAs would be evaluated on inclusion of economic, environmental, social, and resiliency measures. It was further specified that project BCRs alone could not be used for approval or rejection, and HUD encouraged the inclusion of nonquantifiable components. One project stakeholder felt that the project was able to prioritize social and environmental equity components because HUD does not reject projects based on cost-effectiveness.

The OCWP BCA frequently references LMI populations and includes data related to poverty and racial and ethnic groups in its discussion of the project target area. Furthermore, while the BCA quantifies avoided property damage and other economic impacts, it also quantifies social and environmental benefits not often included in traditional BCAs. Benefits calculated in the BCR were categorized as resiliency benefits, environmental benefits, social benefits, and economic revitalization (Arcadis 2015). The BCA also included qualitative narrative justifications for the use of various

resiliency measures, environmental values, and social components, with evidence-based rationale and other literature supporting the effectiveness or impacts of selected indicators. According to interviewees, the benefit considerations were extensive, with no stakeholders mentioning a measure or consideration missing from the BCA.

Resiliency benefits included avoided direct physical damages to buildings, their contents, and inventory; essential facility and critical infrastructure service loss; human impacts; and economic losses. The direct physical damages category of benefits was calculated for structures and buildings, critical or essential facilities, and transportation. Calculations were based on replacement value, a more traditional measure. Also categorized were some less traditional benefits, such as losses avoided associated with displacement or relocation, mental health, stress or anxiety, and sheltering. Avoided losses of productivity and casualties are also quantified.

The social value measures include gathering spaces, with quantified recreational benefits, health benefits, and aesthetic benefits. These benefits were calculated using health cost reductions and willingness to pay values. Of the benefits cited as net present values, approximately 50 percent are categorized as social benefits. Another somewhat unique dimension of the project's BCA was the quantification of expected economic gains associated with the addition of new retail and service space, employment, housing benefits, and related economic outputs—all of which were categorized as economic revitalization.

The avoided economic impacts considered in the BCA were also extensive, with impacts to specific industry outputs and sectors calculated using economic impact assessment software. The BCA also articulates nonquantifiable or qualitative benefits. For example, affordable housing is included as a qualitative benefit with the rationale that if households spend a smaller share of their income on housing, they will have more resources to invest into the economy. Similarly, improvements to light rail infrastructure are justified by describing the effect on people's ability to get to and from work. Qualitative environmental benefits, such as improved water quality and urban heat island mitigation, are also cited.

COMMUNITY ENGAGEMENT AND COMMUNICATION

A core evaluation component of the NDRC was the quality and extent of community engagement. Strategies for the OCWP were informed in part by a “Dutch Dialogues Virginia” program, a five-day event in June 2015 during which regional civic leaders collaborated with water management experts from the Netherlands and New Orleans to learn about integrated water management solutions for communities living with water.³¹

Early OCWP community meetings were held at various locations across affected neighborhoods, with a range of stakeholders targeted for participation. Six community design workshops were held with neighborhood residents, nonprofit group representatives, school staff, and staff from five city departments. Other engagement activities were conducted in partnership with area community and nonprofit groups, including Wetlands Watch and the Elizabeth River Project. Various community groups were also invited to join weekly meetings with Arcadis. Project architects met with city staff, the area housing authority, neighborhood residents, and even school-age children. One project stakeholder noted that planners visited neighborhood schools and asked the children how they would like to enjoy outdoor spaces, what they wished they could do outside, and what about the area's natural environment they were interested in and that the children's responses were incorporated into project plans. To ensure that resident questions and concerns about acquisitions were addressed, the Office of Resilience conducted door-to-door outreach to residents whose homes would be affected and provided information and communication about the project plans, acquisitions, and easements.

The city kept the community informed about the project and its progress through periodic updates. An interviewee recalled that project newsletters were circulated throughout the community, with the most recent newsletter released in January 2021. Periodic project updates were also distributed to Norfolk State University, USACE, and to the Rockefeller Foundation's 100 Resilient Cities program, as Norfolk was one of the first 33 cities to participate in the program. Among project sponsors, the perceptions of OCWP community engagement activities were positive; among community stakeholders, attitudes were mixed. One project stakeholder reported that a community engagement coordinator initially liaised between neighborhood groups and project planners, but the position was eliminated. The stakeholder shared that after that, public housing residents became less involved. Another community member expressed that even though multiple touchpoints existed, community members did not feel they were adequately integrated into project plans and questioned whether the engagement was conducted in earnest.

OTHER EQUITY CONSIDERATIONS

HUD required some of the equity-building activities in the project. According to HUD statute, at least 50 percent of CDBG-DR funding was required to benefit an LMI population, a lower threshold than the 70 to 80 percent required for CDBG awards that are not part of the disaster recovery program. HUD also required an EIS to evaluate project impacts, including social justice and environmental outcomes. The EIS concluded that LMI households and people of color would benefit in the long term from reduced frequency of flood events, improved access in and out of the area, and enhanced community amenities.

Beyond the project BCA, HUD was interested in broader project equity considerations, including public desirability and whether the project addressed unmet needs.

In addition to the federal specifications, OCWP planners noted attempts in the design solutions to be transparent—literally, in one case: one pump station near Resilience Park is being constructed with a large Plexiglas window so the internal operations and mechanics can be observed.

Findings

DISTRIBUTIVE EQUITY

Unlike all the other cases, OCWP tried through its project planning and BCA development to include distributive equity by including new benefits and costs that would be incurred by vulnerable communities and attempting to measure the disproportionate distribution across all benefits and costs. One stakeholder commented that HUD “left an open book” for determining benefits, and they felt the city took full advantage of that flexibility when developing the project BCA. Another project planning stakeholder reported that because planners could use nontraditional social and environmental indicators, in addition to traditional property and economic measures, the project’s BCR was approximately 10 times higher than it would have been.

REPARATIVE EQUITY

Like BIG U, project planners reported that giving priority to LMI populations and ensuring community participation were core project considerations from the start, influenced in part by HUD’s NDRC requirements. The OCWP project was specifically planned for Norfolk neighborhoods with the greatest concentration of LMI residents, aligning with the CDBG-DR mandate that at least 50 percent of project beneficiaries be from LMI populations.

Beyond project requirements, city stakeholders reported that concern for low-income neighborhoods affected by nuisance and storm-induced flooding predated the competition, and there was recognition that chronic flooding in these areas contributed to poverty in the area. As far back as 2013, flooding of the Grandy Village and Chesterfield Heights neighborhoods was identified as exacerbating inequalities in Norfolk, and city leadership prioritized flood resilience project components to benefit these areas first (Communitas Consulting 2014).

PROCEDURAL EQUITY

NDRC requirements also influenced community engagement throughout the project's prioritization, planning, and development phases, with project stakeholders reporting that robust community engagement was high on the list of project requirements to receive NDRC funding. Even so, stakeholders expressed different views of the quality of community engagement and participation in project planning and decisionmaking.

Particularly during the planning phases, project planners reported significant efforts to solicit and engage affected residents to ensure their priorities would help shape plans. They also sought to bring residents in on the more technical and procedural aspects of development, such as by ensuring that residents who may be most affected by acquisitions can make voluntary decisions after receiving extensive communication and information. One project sponsor described the community engagement as very thorough, saying, "I've never seen so much community outreach." Media reporting from the time highlights a similar perspective from the city's environmental consultant, who said: "The City of Norfolk continues to go above and beyond to make certain their citizens are engaged. Hearing their direct feedback motivated our design teams to not only improve flooding, but to improve the overall quality of life for the community through economic vitality, public health, safety, and accessibility."³²

Even so, some community members felt that meaningful community involvement and engagement was lacking; one interviewee ranked the quality as a 2 on a scale of 1 to 10. Others described inconsistent community engagement and participation efforts over the project life cycle. One interviewee recalled being involved in the initial engagement and feedback solicitation process as a public housing resident but felt these efforts were later "cut out" because of budget cuts. Another interviewee criticized the quality of project communication, saying that community members do not receive up-to-date information. Multiple neighborhood stakeholders felt that the current status of the project was unclear to the community, referencing the closure of some streets and unknown re-opening plan. The city publishes up-to-date road closure information on a project website, but one interviewee suggested that "people only know what they see happening on the street." From participant responses, whether this information is well-advertised or accessible to area residents is unclear.

Similarly, although multiple project and city stakeholders described robust involvement with affected community members to ensure that their vision and priorities were reflected in project outcomes, none of those interviewees could describe processes for soliciting input from community members who could not attend the key visioning and comment meetings. One interviewee said that attending community meetings was likely a resident's best opportunity to share priorities and complaints but did not specify whether and how residents who could not attend meetings, such as

parents without child care or non-English speakers, were reached. Another local project sponsor suggested that “anyone left out was not interested” and that the engagement activities were “the most public engagement we could do.”

RECOGNITIONAL EQUITY

Interview responses reveal a disconnect between project implementers and community members on perceptions of project success and satisfaction with whether the project’s processes and products directly considered affected households’ needs, behaviors, and communications. A representative of one implementing agency said, “I really would walk away saying that the community got what they wanted and needed.” Yet a neighborhood stakeholder felt the community’s priorities were left out when some project changes were made, saying, “Listening to people and making it happen are two different things.”

Friendswood Home Acquisition

Challenge: Storm damage; repetitive loss; riverine and coastal flooding

Project size: \$5.6 million

Federal funder: Federal Emergency Management Agency

Other partners: City of Friendswood, Texas; Texas Division of Emergency Management

Cost share: 75 percent federal and 25 percent local (local cost share largely covered through state funding)

Location: Friendswood, Harris County, Texas

Start year: 2018

Status: In progress

Benefit-cost ratio: 0 (not conducted)

Case Selection

The Friendswood Home Acquisition is the only project among the cases to have garnered a zero BCR. In fact, a BCA was not required or conducted for the acquisition because all homes identified for acquisition were either severe repetitive loss properties or the market value of their acquisition was considered cost-effective by FEMA. Friendswood is also the only case project whose federal funding source is strictly FEMA.³³ With the homes located in a predominately middle-class community near Houston, Texas, the project also provides an opportunity for exploring how equity is addressed outside areas that are formally recognized as having social and economic vulnerability.

Case Background

In 2017, Hurricane Harvey ravaged Friendswood, Texas—a small exurban community southeast of Houston—along with much of Greater Houston. Flooding from Hurricane Harvey was not the first warning that flood mitigation was necessary; it has been a persistent problem in the area for decades. Although Friendswood is an inland city, it is vulnerable to storm surge from Galveston Bay and to riverine flooding from nearby Chigger Creek, Clear Creek, Cowards Creek, and Mary’s Creek. Both tropical storms and heavy rainstorms have caused repetitive damage, and the region’s flat topography makes water slow to recede. Yet Harvey triggered the availability of federal funds. A consultant was brought on to support the city with its application in April 2018, and it submitted a proposal as a subapplicant through the State of Texas’s \$5.6 million FEMA Hazard Mitigation Grant Program for the acquisition of 24 “repetitive loss” homes, structures that have been damaged from multiple storm and flood events.³⁴

The city identified the 24 homes for acquisition using a list of known severe repetitive loss properties, defined by FEMA as properties that had excessive National Flood Insurance Program claim payments or homes that were substantially damaged by flooding during Hurricane Harvey and are in a 100-year Special Flood Hazard Area even if their properties did not qualify as severe repetitive loss properties. The Friendswood acquisition involves removing residences from the flood zone by acquiring homes, all of which are owner-occupied, from willing sellers. Homeowners are being offered fair-market values for their homes based on an appraisal from a licensed appraiser, less any insurance claims received so there is no duplication of benefits, and whose appraisal can be appealed. Acquired homes will be demolished to create open park and recreational space, wetlands, and a nature reserve. The open space must remain so in perpetuity and will not be available for future development.

City sponsor interviewees described the acquisition project as simple and routine because of its small size and limited technical requirements, yet it was also described as a long process, with an estimated work schedule of 24 months from signing the grant agreement to closing the grant. According to a city stakeholder, residents were informed that the city had little control over the federal approval timeline. The application was submitted in June 2018 and approved quickly by the state, but FEMA’s approval came more than a year later, in August 2019. The homeowner application stipulated that the process should not exceed 36 months. Home appraisals, surveys, and title searches were expected to take approximately two months, and mitigation offers, closings, and deed recordings were expected to take 12 months. Although property acquisitions began in 2020, it has taken longer than the estimated 12 months for interested sellers to close. June 2021 marks three years since the application and nearly four years since the damage from Hurricane Harvey.

Along with time, money is factor. When homeowners were initially approached in May 2018, the city did not have the funds to cover the 25 percent nonfederal cost-share requirement. As such, the city passed the cost share responsibility to the homeowners through a 25 percent devaluation of the home purchase price, which sponsors hoped would be covered by homeowners' insurance policies. Rather than accept a devalued offer for some unknown time in the future, some homeowners decided to "cut their losses" and sold their homes to other buyers. In 2019, Texas passed legislation to cover local cost shares for hazard mitigation projects related to Hurricane Harvey through set-aside funding, and participating Friendswood homeowners were eventually guaranteed the full sale price of their homes.

These delays and rule changes have taken a toll: as of February 2021, four homes have been acquired and three other acquisitions are in negotiation. Although 24 homes were included in the application—which required an expression of interest from property owners at the time—17 have since withdrawn. City sponsors speculated that the two-year waiting period may have led some homeowners to reconsider, either because their post-Harvey fears have quieted or because they ultimately had the financial means to wait and move.

Analysis

PROJECT BENEFITS AND TRADE-OFFS

City stakeholders described the primary benefits of the project as both the removal of residents from a flood zone so they are no longer at risk and the creation of community open spaces. There is some debate among stakeholders about whether the purported benefit to homeowners of being out of harm's way is proportional to the loss of their residences—even with compensation—such that while they do participate voluntarily, they do so at a significant personal loss. One stakeholder described the hesitation to participate: "Usually, it's 'this is my family land and where I raised my kids—I'm not ready to move on.'"

Another consideration for homeowners discussed in interviews was whether to wait through the long and opaque process of having their homes acquired or to avoid the acquisition process by either moving without federal assistance or staying in place and risking damage from future hazard events. One city stakeholder estimated that the longer the acquisition process took, the more homeowners had the chance to reevaluate the flood risks they faced, with perceived risks declining as the time since Hurricane Harvey grew. Multiple residents who signed a notice of voluntary interest for the application did not accept the offer they eventually received, and one city stakeholder speculated that they did not

have the means to wait several years for a buyout or were concerned that the city could not guarantee the entire cost of the home. Instead, some sold their properties privately.

A final consideration raised regarding project benefits is whether the project's reduced scope will affect the intended flood mitigation benefits at a reasonable cost to the city. One city stakeholder said that from a city management perspective, acquiring at-risk properties provides no benefits unless their acquisition is part of a combined flood mitigation project. Although piecemeal acquisitions benefit individual property owners, the removal of properties also decreases the city's tax base and increases maintenance obligations while the potential for flood mitigation projects associated with open space is still limited. The relative impact is particularly pronounced for smaller communities such as Friendswood. From this stakeholder's perspective, the loss of 17 homeowners from an original 24 interested parties means this was not a successful application.

BENEFICIARIES AND STAKEHOLDERS

Interviewees described key project beneficiaries and stakeholders as the owners of the properties targeted for acquisition, as well as the city of Friendswood more broadly. Friendswood is relatively affluent and majority-white, but city sponsors reported that the owners of homes identified for acquisition had a range of incomes. FEMA statutorily allows property owners to be offered up to \$30,000 above market value if the share of LMI residents is higher in a buyout area than in the community overall—what one interviewee referred to as “environmental justice payments.” The Friendswood project was not eligible because neither the city nor the project area has a substantial LMI population. One stakeholder described Friendswood as “much more affluent” than cities and neighborhoods where environmental justice funding is received.

BENEFIT-COST ANALYSIS

The project application had a required cost-effectiveness component, but a BCA was not required. The homes identified for acquisition are severe repetitive loss structures located in Flood Zone AE (as categorized by FEMA flood insurance rate maps), an area with a 1 percent annual chance of flooding and a 26 percent chance over the life of a 30-year mortgage. Furthermore, 12 of the 24 targeted structures were classified as substantially damaged from Harvey. As such, 12 properties met the criteria for the BCA waiver for substantially damaged properties, and no BCR was calculated. The remaining 12 met the criteria for precalculated benefits, given their locations in a 100-year Special Flood Hazard Area. Because Friendswood demonstrated that the 12 properties that did not receive a substantially damaged property waiver could be acquired for an average cost of less than \$250,000, their acquisition was considered cost-effective, and a BCA was not required. Although the BCR field was left blank in the

application and reported as a 0 in FEMA Hazard Mitigation Grant Program data, BCRs were calculated for the 12 properties without a waiver. The BCA consultant shared that although the analysis is not required, it is valuable to demonstrate that accurate cost data are presented.

The quantified acquisition included home appraisal estimates plus costs associated with buying and demolishing a home. The consultant used Zillow to identify cost estimates, and other transaction-related expenses, such as title insurance, legal/closing costs, and deed recording fees, were included as cost considerations. There were additional costs associated with demolition and open space creation, such as asbestos remediation and debris removal. A flood model was also used to help determine whether acquisitions were cost-effective.

COMMUNITY ENGAGEMENT AND COMMUNICATION

Recruitment of homeowners to be included in the application took place in May 2018, one month after the city decided to engage a consultant to help develop their application and approximately nine months after Hurricane Harvey. The city contacted people whose properties flooded in Hurricane Harvey using a list of known severe repetitive loss properties. Outreach was conducted to repetitive loss property owners that had damage from Hurricane Harvey as well. A meeting was held at City Hall for anyone in the flood plain footprint, and city representatives and their consultant gave a presentation about the buyout process. If residents expressed interest in the acquisition, they were assessed for eligibility and included in the application.

Homeowners do not have the opportunity to engage directly with FEMA, which sets qualification criteria and related requirements. If residents have issues or concerns, the city must act as the intermediary, and this can contribute to procedural and communications opaqueness and delays.

OTHER EQUITY CONSIDERATIONS

City sponsor stakeholders reported no external statutory requirements or internal project considerations for equity beyond consideration of a property's physical vulnerability to flood events.

Findings

In the community associated with this case, socially vulnerable households were neither the project focus nor the unintended beneficiaries because physical exposure was the overriding eligibility criterion. Yet, even here, there were equity concerns.

PROCEDURAL EQUITY

Although the decision to apply for Hazard Mitigation Grant Program funding originated with the city, residents had agency in deciding whether to participate. All buyouts were voluntary and open to any property deemed eligible. City sponsors reported that no residents who wished to participate faced barriers to eligibility. If a homeowner was unhappy with their home valuation, project stakeholders reported they could secure a second appraisal at their own expense. Although described as a benefit to homeowners, this could disproportionately benefit those with the means and access to secure additional appraisals.

Despite the apparent transparency and fairness, the length of time between application submission, approval, and acquisition was a significant barrier for many homeowners. City sponsors reported that the process for receiving approval at the federal level was slow and opaque, and the protracted implementation period disappointed residents who wanted, or may have needed, the acquisitions to occur sooner. Not all property owners included in the application had the means or ability to wait two years, and no support was available for community members who could not sustain the wait.

DISTRIBUTIVE EQUITY

Although Friendswood is not a racially or ethnically diverse community and project stakeholders described it as affluent, households with lower incomes are represented. City project stakeholders suggested that those with greater financial means benefited more from the acquisition program than those with less. That most households from the initial application are not planning to move forward with acquisition suggests some residents were better positioned to wait for acquisitions than others and that the project plan did not address the scope of community needs.

One city stakeholder stated that the initial 25 percent local cost-share requirement likely marginalized residents who were not financially able to make up this loss, whereas those with greater means could afford it. As such, not only did the federal investment go toward a community of means, but it possibly went to its wealthier residents as well.

Conclusion

Summary of Cases

The five cases paint a picture of the inconsistent consideration of social equity across federally funded flood mitigation investments, illuminating a patchwork of community, neighborhood, and even individual-level disparities that vary by federal agency, project locale, and local sponsor priorities. Each case differs in its inclusion of social equity within and beyond BCAs, yet no stakeholder reported that their respective project's consideration of equity was contingent on the BCA. Indeed, projects were often successful in advancing distributive, procedural, recognition, and reparative equity despite the use of traditional BCA techniques. Likewise, projects tied to other statutory equity requirements were more successful in prioritizing underresourced neighborhoods and LMI households and people of color.

Still in the ideation phase, the USACE's CSRM in Miami-Dade County, Florida, has already met with equity challenges in project selection, processes, and decisionmaking. USACE used a novel approach to identify areas for project siting that have high social vulnerability and high economic loss potential. Stakeholders said the use of these data and tools reflected positive movements at USACE, but wealthier and white areas ultimately appear to have received greater priority. Likewise, many interviewees reported that procedural equity considerations—such as public engagement, comment response, transparency in decisionmaking, and ongoing communications—have been lacking. CSRM's traditional BCA does not consider the distribution of benefits and harms. This omission could compound differences in racist property valuations and fail to take into account that property damage and loss is a greater economic shock for people with low incomes.

In contrast, the completed, multifunder AVRP project in Lincoln, Nebraska, was designed to protect neighborhoods whose residents are primarily people of color and LMI households from increasing riverine flood events while addressing the city's transportation challenges and revitalizing historically underresourced neighborhoods. A traditional USACE BCA was used for the flood control project components, but project planners secured additional funding for community revitalization and engagement that prioritized social equity without a BCA. Recognition of the city's historical disinvestment and the project's potentially disproportionate impacts in communities of color prompted the city to extend community engagement many years and incorporate community benchmarks. In the end, project leaders said that if evaluated individually, each of the project's three-legged priorities—flood mitigation, transportation, and community revitalization—would not be considered as successful as community and city leaders view the project to be overall, in large part because of the trade-offs deemed necessary to prioritize social equity goals regardless of the BCA's findings.

The BIG U/ESCR in New York City recently initiated construction after being among the winners of HUD's 2014 Rebuild by Design competition, which required that in addition to flood resilience, projects primarily benefit LMI neighborhoods and include iterative community engagement throughout design development and selection processes. The transition from development to implementation involved both distributive and procedural equity failures. Planners reported that poorly operationalized project goals like resilience and community cohesion "just did not show up in the numbers," and the project plan was dramatically changed with little community consultation. Many residents have lost trust and confidence in the project despite the project's ultimately positive potential outcomes.

The OCWP in Norfolk, Virginia, is currently under construction after receiving a HUD award in 2016 to support natural storm water management and flood mitigation while adding recreational and outdoor learning opportunities. Project planners included a wide variety of social, cultural, and environmental measures in the project BCA and instituted community engagement and feedback solicitation activities to incorporate residents' priorities. OCWP stakeholders reported robust and creative community engagement efforts to ensure procedural equity and prioritize feedback and involvement from socially vulnerable stakeholders; however, some community members questioned whether the city acted in good faith, such that engagement has declined over the project's life cycle and consultation has been lacking at key project benchmarks.

The Friendswood home acquisition project to acquire and demolish 24 repetitive-loss residences is still in the development phase after it was sponsored by the City of Friendswood, Texas, and received funding from FEMA in 2018. FEMA did not require a BCA for the acquisitions because of the severe exposure of the properties. No social equity considerations were explicitly considered, yet delays in implementation and gaps in transparency may have disproportionately affected residents who could not afford to wait out the process. Most residents are dropping out of the project, and planners question its success as the attrition precludes the redevelopment of a related nature preserve.

Cross-Cases Themes

Patterns emerged from the findings in the five cases based on the structured analytical themes.

Project Benefits and Trade-Offs

Stakeholders across the five cases identified a range of economic, infrastructural, environmental, and social project benefits, as well as environmental, funding, time, and social harms trade-offs. The CSR in Miami-Dade County focused heavily on flood mitigation benefits that planners say will serve the entire

county, with modest attention to other social or cultural benefits. The acquisition project in Friendswood, Texas, similarly focused little on social or cultural benefits, instead touting the removal of residential properties from flood exposures. In contrast, the AVRP in Lincoln, Nebraska, planned for a suite of economic, infrastructural, and social and cultural benefits from braided flood mitigation, transportation expansion, and community revitalization projects. Similarly, the reported benefits of the early Big U/ESCR plan in Lower Manhattan balanced flood mitigation protection with other social goals, such as increasing community access to public park spaces and enhancing community resilience and connectedness. The OCWP in Norfolk, Virginia, also sought flood reduction goals with enhancements to natural amenities and increased economic and social connectivity between priority LMI neighborhoods and the rest of the city.

In Miami-Dade County, community stakeholders said that green infrastructure was left off the table, in addition to the oversight of not prioritizing socially vulnerable populations. In Friendswood, the benefits have come at a significant time cost. In contrast, the trade-offs for the AVRP in Lincoln were described as an ultimate benefit by planners because the project's components may not have been considered cost-effective on their own; trade-offs in this case led to trading up. In New York, the core trade-offs of the BIG U/ESCR project were procedural; significant planning, public engagement, and communications challenges resulted from the transition between community visioning facilitated by RBD and project implementation facilitated by the city. Similarly, project trade-offs in Norfolk's OCWP centered on process; the perception of poor communication caused some stakeholders to question the project's overall benefits.

Beneficiaries and Stakeholders

Proponents described project beneficiaries either as the geographically defined community or region (with no distinction for populations or social groups) or using the race, income, age, or historical disinvestment criteria. Project stakeholders in Miami-Dade's CSRM reported that the county as a whole was the project beneficiary, with one sharing the view that targeting any specific population or neighborhood would be unfair. Similarly, planners of the acquisition in Friendswood said no population within the group of owners of exposed properties was targeted. In contrast, project planners of the AVRP in Lincoln, the Big U/ESCR in New York, and the OCWP in Norfolk all reported recognizing and directing beneficiaries through a combination of social criteria, including communities of color, LMI populations, older adults, non-English speakers, and historically underresourced neighborhoods. In prioritizing beneficiaries and stakeholders, interviewees also reported a wide variety of benefits for the entire community.

Benefit-Cost Analysis

The cases' use of BCA ranged across a dual axis of BCA inclusion/exclusion and traditional/novel valuation methods and criteria. The Friendswood acquisition included no BCAs and used no other methods for project prioritization. The CSR in Miami-Dade used traditional USACE BCA metrics and calculations and prioritized BCRs well in excess of the requirement that the ratio be greater than 1. The AVR in Lincoln, Nebraska, also used traditional USACE BCA metrics and calculations for flood mitigation project components but supplemented the BCA with multiple other valuation and project prioritization criteria and methods, including requiring no BCA for social and cultural project components. In New York, the Big U/ESCR also supplemented traditional BCA project requirements by requiring planners to prioritize socially vulnerable populations. In Norfolk, Virginia, the OCWP significantly expanded the measures included in project BCAs to include social and environmental valuations.

Community Engagement and Communication

Community engagement varied across projects but generally met the requirements imposed by federal funders. In Friendswood, Texas, planners reported no communications plan and infrequent communication between FEMA and the community, a procedural gap that contributed to attrition among potential participants. Likewise, community stakeholders reported that communications and engagement in Miami-Dade County, though nascent, are “the bare minimum” and off to a tenuous start. In contrast, both BIG U/ESCR and OCWP project stakeholders described initially robust engagement activities but said that communications declined significantly in later implementation. In contrast, the long and inclusive view toward community engagement taken by project planners of the AVR in Lincoln, Nebraska, shows concerted prioritization for procedural fairness for the most affected residents throughout the project's life cycle.

Other Equity Considerations

Stakeholders in the five projects reported various voluntary and statutorily required ways that equity was considered. No equity considerations or efforts were reported in the Friendswood, Texas, acquisition program. In contrast, LMI beneficiaries in the BIG U/ESCR, OCWP, and AVR plans were identified *a priori*. AVR and OCWP planners did so because they recognized past harms and disinvestments. All but the Friendswood project included robust EISs that included more equity considerations than their BCAs. Project leadership in OCWP and AVR also made concerted efforts to help affected residents understand the breadth and depth of project plans and technicalities far beyond any federal funder requirements.

Recommendations

The BCA is one tool to advance equity, but BCA alone is not adequate for addressing distributive, procedural, recognitional, or reparative equity considerations for every project. As in the OCWP and the BIG U/ESCR, challenges to procedural equity may arise even when social and environmental equity measures are included in project BCAs. Likewise, the failures of the Friendswood acquisition project to recognize different populations' needs belie the program's neutrality.

Project, community, and federal stakeholders shared recommendations to increase social equity both within and beyond statutory and BCA requirements for federal flood mitigation infrastructure investments. Evidence from the case studies in this report suggest that the respondents' recommendations are sound. We supplement these with other evidence-based recommendations categorized by this study's equity dimensions. Despite the study's limited purview and the challenge in generalizing from its cases, the Urban team believes the findings shed light on how public actors define what is valuable and which communities are viable via flood infrastructure and, more importantly, how this definition and its operational tools can evolve—as they should.

Advancing Distributive Equity

To paraphrase Melvin Kranzberg's first law of technology, infrastructure is neither good nor bad, nor is it neutral. Transparency around benefits and harms, particularly as these are accrued disproportionately by different communities, can at least help ensure that infrastructure is not bad. Expanded measurements that account for distributed impacts, as well as multiple criteria and analyses, can help assess and promote equity in projects. New benefit definitions, new measurements for monetizing them, and new methods for showing how values are distributed across project beneficiaries can help ensure, at least by design, equitable outcomes.

INCREASE BCA FLEXIBILITY, CRITERIA, AND ASSUMPTIONS

The first recommendation for BCA is to increase its flexibility and the breadth of its criteria and assumptions. Traditional BCA calculations value monetizable costs and benefits and may exclude myriad social, cultural, psychological, environmental, and related intersectional impacts, which often disproportionately affect people of color and LMI households. Multiple project stakeholders suggested that their exclusion from BCA is not warranted just because some such measures may seem difficult to operationalize. Indeed, projects such as the OCWP successfully quantified numerous measures, and stakeholders from other projects discussed creative ways whereby such measures could be quantified.

They include the loss of housing, access to jobs and job services costs, socio-psychological health impacts, and community revitalization.

INCLUDE MEASURES FOR THE DISTRIBUTION OF PROJECT BENEFITS AND COSTS

BCA should consciously account for the distribution of benefits and costs. Project planners on multiple cases emphasized that monetary benefits and harms disproportionately affect income and social populations. Indeed, as one stakeholder described, \$1 million in damages to an insured corporate high-rise where no one lives is much different from the same losses spread out over multiple homes in an LMI neighborhood. The latter scenario would result in the loss of homes and belongings for some families, with cascading effects on employment, health, and quality of life. Yet traditional BCAs prioritize higher property values. Weighted valuations can be developed to compensate for the relative impact of property losses on LMI households' financial well-being and to compensate for neighborhoods' cascading economic losses.

WEIGHT CRITICAL INFRASTRUCTURE

Respondents suggested that weight should be applied when valuing across property types. Stakeholders noted that BCA does not capture the true use value of infrastructure and that adjusting valuations by property or infrastructure type would improve BCAs' accounting of real value and loss potential. For example, one project stakeholder in Miami described their advocacy to USACE on the Back Bay study to increase the weighted value of certain critical infrastructure, such as sewer pump stations; the failure of the stations during a flood event could have catastrophic public health and safety outcomes despite their relatively small size and square footage.

CORRECT RACIAL DISCOUNTING IN PROPERTY VALUATIONS

Weighting different benefits and assets creates a fairer game, but the playing field is still uneven. Current real estate valuation techniques repeat historical racism from redlining and consequent racial discounting. Multiple respondents discussed the racialized impacts of calculating costs and benefits primarily by property value, which disproportionately benefits both white and higher-income property owners. BCA could be conducted to adjust or control for differential valuations of similar properties by race, such that the damages to residences of comparable quality and size would be similarly estimated, rather than using the pre-flood values.

CONSIDER QUALITATIVE CRITERIA AND ASSESSMENTS

Proponents noted that numbers may ultimately not be able to account for all inequitable conditions. Consequently, BCA reporting should include qualitative analytical methods, which should be given due consideration along with the numeric ratio that is typically produced. Project stakeholders noted that some funding agencies, including HUD and FEMA, already consider qualitative benefits. Where BCA cannot rely on available data or innovation, program officials must triangulate findings with multiple studies, impact assessments, and selection criteria. BCAs are but one measure of project benefits and costs, but there are additional quantitative and qualitative criteria and assessments that can be used together to prioritize project selection, as was done in the AVRPP.

BCA SHOULD NOT BE THE SOLE DETERMINANT OF INFRASTRUCTURE INVESTMENTS

Respondents noted that, despite its momentum, the BCA cannot be the primary measure of a project's value. The OCWP included many social and environmental equity criteria in its BCA, though these did not guarantee equitable outcomes. For AVRPP stakeholders, the BCA was effectively inconsequential, and other studies were commissioned to provide more nuance, accuracy, and possibility for alternatives.

Advancing Procedural Equity

Social policy experts underscore the importance of process as much as outcomes in community projects that involve significant environmental change. Indeed, social scientists have found that perceptions of community trust, agency, information access, and procedural fairness can elicit stronger support or opposition than the purported benefits of a project alone (Haggerty et al. 2018; van Putten et al. 2018; Zhang et al. 2018). Consequently, expanded and improved community engagement activities must be employed to ensure that affected residents are included in the decisions about their lives and livelihoods and can inform the contours of those decisions. This engagement includes discussions about possible benefits and costs. Community social license for large-scale infrastructure investments is needed for project advancement—as community revocation of social license has stymied many siting plans (Colvin, Witt, and Lacey 2016). Rather than one-time approval solicited from community members before the groundbreaking, social license must be continually secured as project plans evolve. Planners and sponsors can incorporate benchmark checkpoints where community agreement or consent is continually solicited, and agreements can be formalized in writing.

EXPAND AND STRENGTHEN COMMUNITY ENGAGEMENT AND CONSENT ACTIVITIES

Procedurally, community engagement and consent requirements need to be expanded and improved. Multiple interviewees suggested that setting requirements for community engagement would help ensure fundamental fairness. Interviewees discussed establishing clear communications and consent criteria, frequency of interaction, and activities at the project outset as possibilities to ensure that communications and engagement are meaningful and measurable. Participants suggested tying such activities with approvals at key project benchmarks.

INCREASE PUBLIC UNDERSTANDING OF PROJECT ACTIVITIES AND TECHNICALITIES

A corollary to the recommendation for engagement is the accessibility of technical information. Stakeholders on all projects discussed the importance of public understanding of a project's activities and goals so community members are more engaged and can better shape the project. Interviewees said that project sponsors must be able to discuss project technicalities in compelling and thorough ways and not withhold information because of a perception that the public lacks the sophistication, time, or interest to engage.

ACCOUNT FOR THE UNEQUAL IMPACTS OF PROTRACTED PROJECT TIMELINES ON LMI POPULATIONS

Because infrastructure planning, design, construction, and maintenance are extended activities, community engagement includes understanding how changes over time must be communicated transparently and accessibly. Particularly for flood mitigation investments that involve payments or other supports to households—as in the Friendswood case—the effect of time on LMI populations should be accounted for in project plans. Clear communication channels and resources between federal funders, local sponsors, and participating households must be established, and local sponsors can provide cost-share supports or otherwise prioritize LMI residents whose financial situation does not allow them to wait for unknown lengths of time for action.

Yet time is often expensive, and community engagement is resource-intensive. Planners often argue that projects still in the proposal stage or early in the planning stage—like the CSRM in Miami—are also too early for community engagement; further project development would, in theory, provide more information and fodder for public discussion. However, a strong counterargument to delaying active engagement through the project's formation is that without early engagement, the project will continue to gain momentum from officials and funders and will reach the point where a decision becomes inevitable and therefore later community engagement becomes futile.

Advancing Recognitional Equity

IDENTIFY PROJECT LEADERS WHO REFLECT AFFECTED COMMUNITIES

Identifying subpopulations that have experienced historical disinvestment or otherwise borne disproportionate burdens from past infrastructure investments results in cascading improvements to project plans and decisionmaking across distributive, procedural, and reparative equity domains. Advancing recognitional equity can be accomplished beyond BCA calculations, by prioritizing socially vulnerable beneficiaries and by identifying project leadership that reflects the affected communities from an early point. Information on the range of demographic, financial, environmental, and social needs and behaviors of the affected communities can ensure a better infrastructure decision and process. Respondents emphasized the importance of having “the right people on the bus”—that is, ensuring that the officials who approve projects include people from the communities intended for infrastructure investment.

Advancing Reparative Equity

PRIORITIZE SOCIALLY VULNERABLE, HISTORICALLY UNDERRESOURCED, OR MARGINALIZED BENEFICIARY POPULATIONS

Respondents noted the importance of a holistic approach to equity in flood mitigation that includes reforming BCA. To start, prioritizing the most vulnerable households and communities as an eligibility criterion can help ensure that past inequities are considered. Stakeholders associated with the BIG U/ESCR, AVRIP, and OCWP shared that the project beneficiaries—primarily neighborhoods of LMI households and communities of color—would likely not have been selected for project siting and mitigation activities had traditional BCA or related property valuation techniques been used. Designating communities of color and LMI populations from the start advances distributive equity and prioritizes vulnerable people over exposed property. Despite varied project outcomes that result from procedural, statutory, and project management differences, stakeholders on these projects agreed that prioritizing communities of color and LMI populations from the start was vital to advancing distributive equity, as strict monetary or other quantitative BCAs would likely not find their prioritization cost-effective. Programs must establish similar eligibility criteria or priorities to reduce the ambiguity that BCA leaves.

WAIVE COST-SHARE REQUIREMENTS FOR LOW-INCOME JURISDICTIONS

Stafford Act and Federal Insurance and Mitigation Administration rules articulating the cost-share requirements for federal infrastructure investments exacerbate disparities in resource access. In

Friendswood, Texas, project stakeholders said that because the community is small, they were unable to meet federal cost-share requirements, so the city passed the cost share responsibility to the homeowners through a 25 percent devaluation of the home purchase price. Project sponsors hoped this would be covered by homeowners' insurance policies, but this devaluation was a key factor in attrition among lower-income homeowners who could not afford to incur that loss.

In myriad other jurisdictions with fewer resources and greater numbers of high-poverty neighborhoods than Friendswood—where community stakeholders described the population as fairly affluent—cost-share requirements are too onerous for the jurisdictions to apply for federal investment aid in the first place. Yet many such jurisdictions are most in need federal investment, and because they lack financial and political capital assets to apply for federal investment aid—let alone meet federal cost-share requirements—their needs go unrecorded and unmet.

Congress has adjusted or waived federal cost-share requirements following significant disaster events, but low-income jurisdictions face barriers to qualification and access regardless of the precipitating event. To advance reparative equity in historically underresourced or LMI communities, federal cost-share requirements can be waived entirely.

In all these ways, equity can be more than an aspiration for flood planners and mitigation engineers—it can be feasibly built.

Appendix. Landscape and Case Selection

TABLE A.1
Number of Statutory and Regulatory Documents Reviewed, by Agency

Agency	Policy	Program rule	Regulation	BCA	Guidance
US Army Corps of Engineers	1	-	1	-	4
US Department of Housing and Urban and Development	1	5	1	2	1
Federal Emergency Management Agency	-	4	3	3	2
National Oceanic and Atmospheric Administration	1	-	-	2	-
US Environmental Protection Agency	1	1	-	-	-
US Department of Agriculture	2	1	-	1	2
Total	6	11	5	8	9

Note: BCA = Benefit-cost analysis.

TABLE A.2

Projects for Case Selection, by Criterion

Project	Status	Flood type vulnerability	Project size	Funding source	Geography, region, and sociodemographics	BCA variation	Other equity implementation
Miami-Dade Back Bay Coastal Resilience Plan	Planning stages, c. 2018 to present	Coastal, storm surge	Large (\$4.6 billion)	USACE	Southeast Florida; urban and rural; county-wide	Standard USACE BCA, calculations include structural and nonstructural measures; selected alternative BCR 9.4	Environmental justice and social vulnerability indexes included in project selection but not in BCAs
Antelope Valley Redevelopment Project	Completed, c. 1992 to 2017	Riverine	Medium (\$246 million)	USACE; HUD; Federal Highway Administration; municipal; private	Lincoln, NE; urban; citywide	Several BCA calculations based on cost savings from floodplain property acquisition All BCRs "at least 3:1"	Prioritized historically marginalized neighborhoods and neighborhoods of color, with resources expended beyond those calculated in BCAs
BIG U/East Side Coastal Resiliency Project	In progress, c. 2014 to present	Coastal, storm surge	Large (\$1.45 billion)	HUD CDBG-DR Rebuild by Design	New York City; urban; Manhattan	Standard HUD BCA for three component projects BCR range: 1.47-3.03	Prioritized LMI populations and procedural equity in project planning
Ohio Creek Watershed Project	Near completion, c. 2014 to present	Coastal, storm water	Small-medium (\$130 million)	HUD CDBG-DR NDRC	Norfolk, VA; small urban; LMI priority	Included social, cultural, and environmental measures BCR range: 1.06-2.03.	Low BCAs accepted; used social and environmental measures in BCAs; prioritized LMI neighborhoods and neighborhoods of color
Friendswood Home Acquisition	In progress, c. 2018 to present	Storm water	Small (\$5.6 million)	FEMA-HMGP	Friendswood, TX; suburban/exurban	FEMA cost-effectiveness of severe repetitive loss properties BCR: 0	Low/no BCR accepted because average cost of properties was under \$276,000 or properties were categorized as severe repetitive losses; no equity requirements

Notes: BCA = benefit-cost analysis; BCR = benefit-cost ratio; CDBG-DR = Community Development Block Grant Disaster Recovery; FEMA = Federal Emergency Management Agency; HMGP = Hazard Mitigation Grant Program; HUD = US Department of Housing and Urban Development; LMI = low- and moderate-income; NDRC = National Disaster Resilience Competition; USACE = United States Army Corps of Engineers.

TABLE A.3

Case Selection Documents, by Project

Project	BCA	Plan	EIS	Community engagement	Formal communication	Assessments	Total
Miami-Dade Back Bay Coastal Resilience Plan	Yes	Yes	Yes	Yes	Yes	-	4
Antelope Valley Redevelopment Project	Yes	Yes	Yes	Yes	Yes	Yes	6
BIG U/East Side Coastal Resiliency Project	Yes (3x)	Yes (2x)	Yes	Yes	Yes	Yes	9
Ohio Creek Watershed Project	Yes	Yes	Yes	-	Yes	-	4
Friendswood Home Acquisition	Yes	Yes	-	-	-	-	2
Total	7	6	4	3	3	2	25

Notes: BCA = benefit-cost analysis; EIS = environmental impact statement.

TABLE A.4

Interviews, by Project

Case	Federal funder	State/ implementing agency	BCA author/ consultant	Community advocate	Local sponsor	Total
Miami-Dade Back Bay Coastal Resilience Plan	-	1	-	1	2	4
Antelope Valley Redevelopment Project	-	1	2	1	2	6
BIG U/East Side Coastal Resiliency Project	1	3	3	1	2	10
Ohio Creek Watershed Project	1	1	-	1	1	4
Friendswood Home Acquisition	-	1	1	-	1	3
Total	2	7	6	4	8	27

Glossary

Affordable housing: Defined by the US Department of Housing and Urban Development as housing that can be obtained for 30 percent or less of a household's gross monthly income, including utility payments.

Antelope Valley Redevelopment Project (AVRP): A flood control, community revitalization, and transportation project in Lincoln, Nebraska, centered around Antelope Creek.

Benefit-cost analysis (BCA): A quantitative method to estimate the costs and benefits of a proposed project or investment, typically expressed in monetary terms and adjusted for the time value of money.

Benefit-cost ratio (BCR): Ratio used in benefit-cost analyses to summarize the overall value of the monetary gain from completing a project relative to the monetary cost.

Coastal flooding: Occurs when seawater submerges dry or low-lying land during weather events. Coastal flooding is expected to increase in intensity and frequency with climate change.

Community board: Appointed advisory boards for community districts in the five boroughs of New York City. Community boards advise city government on land use and zoning, service delivery, and city budgets.

Community Development Block Grant Disaster Recovery (CDBG-DR): Flexible grants provided by the US Department of Housing and Urban Development to support community recovery after a presidentially declared disaster.

Environmental impact statement (EIS): A documentary assessment of a proposed project's or action's impacts on the surrounding environment. EISs are required by the 1969 National Environmental Policy Act for projects with significant impact potential and must describe positive and negative environmental effects and potential alternatives.

Federal Emergency Management Agency (FEMA): Federal agency within the Department of Homeland Security that leads national efforts to prepare for, protect and mitigate against, respond to, and recover from the impacts of natural disasters and human-made incidents or terrorist events.

Flood insurance rate maps: Maps created by FEMA to delineate areas located within floodplains for flood insurance and rate purposes.

Gray infrastructure: Human-engineered water resource and management infrastructure. Examples include pipelines, reservoirs, levees, or water treatment plants.

Green infrastructure: Approach to water and wet weather management that uses vegetation, soils, and other natural elements to restore or mimic natural water cycle systems. Examples include restoring wetlands, planting trees, and using pervious pavements to decrease water runoff and increase groundwater recharge.

Joint Antelope Valley Authority (JAVA): Coordinated governmental entity created to administer the Antelope Valley Redevelopment Project in Lincoln, Nebraska. JAVA was led by a three-member board of project partners from the City of Lincoln, the University of Nebraska-Lincoln, and the Lower Platte South Natural Resources District.

Low-to-moderate income (LMI): Income classification defined by the US Department of Housing and Urban Development as approximately 70 to 80 percent or less of an area's median household income.

National Disaster Resilience Competition (NDRC): A competition launched in 2014 by the US Department of Housing and Urban Development to award disaster resilience funds to states and communities across the country.

Ohio Creek Watershed Project (OCWP): A flood protection project in Norfolk, Virginia, funded through the National Disaster Resilience Competition.

Office of Management and Budget (OMB): Agency within the Executive Office of the Federal Government responsible for overseeing the performance of federal agencies and administering the federal budget.

Riverine flooding: Flooding that occurs when the volume of water exceeds the capacity of a waterway.

Severe repetitive loss property: A residential property that (a) has at least four National Flood Insurance Program claim payments (including building and contents) of more than \$5,000 each and for which the cumulative amount of such claims payments exceeds \$20,000 or (b) is covered under the National Flood Insurance Program and for which at least two separate claim payments (building payments only) have been made and the cumulative amount of the building portion exceeds the market value of the building.

Social vulnerability index (SVI): Index developed by the Centers for Disease Control and Prevention to calculate a community's ability to respond to hazardous events at the census tract level. SVI uses

socioeconomic and demographic data, such as poverty and access to transportation, to determine an area's social vulnerability to hazard events.

Special Flood Hazard Area: An area having special flood, mudflow, or flood-related erosion hazards where the National Flood Insurance Program's floodplain management regulations must be enforced and where the mandatory purchase of flood insurance applies.

Stafford Act: A 1988 federal law that allows for federal assistance and coordination to states during major disasters and emergencies.

Storm surge: Coastal flooding that occurs with the rising of the sea above normal tide levels, resulting from storm-induced low atmospheric pressure changes and wind.

Uniform Relocation Assistance and Real Property Acquisition Act: A federal law that establishes uniform and fair requirements for the acquisition or displacement of people from their property for federally funded projects.

United States Army Corps of Engineers (USACE): Engineering formation of the US Army focused on building and maintaining infrastructure through engineering regiment, military construction, and civil works projects and activities.

United States Department of Housing and Urban Development (HUD): The federal department responsible for housing policy and programs that addressing housing needs in the US.

United States Environmental Protection Agency (EPA): Federal agency responsible for environmental protection matters, including technical assistance, planning, and surveillance of water, air, waste, and toxin issues.

Urban heat island: The phenomenon where urban air and surface temperatures are higher than nearby rural areas because of differences in how surfaces in each environment absorb and hold heat.

Watershed: An area or ridge of land that separates waters flowing to different rivers, basins, or seas.

Willingness to pay: The maximum amount a customer is willing to pay for a service or product.

Notes

- ¹ “Modernizing Regulatory Review,” memorandum for the heads of executive departments and agencies, the White House, January 20, 2021, <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/modernizing-regulatory-review/>.
- ² “Executive Order on Tackling the Climate Crisis at Home and Abroad,” the White House, January 27, 2021. <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/>.
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- ⁴ Richard L. Revesz, “A New Era for Regulatory Review,” *The Regulatory Review*, February 16, 2021, <https://www.theregreview.org/2021/02/16/revesz-new-era-regulatory-review/>.
- ⁵ “Modernizing Regulatory Review,” the White House.
- ⁶ The National Oceanic and Atmospheric Administration also plays a role in federal flood mitigation but primarily for data, analysis, and planning and rarely for actual infrastructure projects.
- ⁷ “Civil Works Budget and Performance,” US Army Corps of Engineers, accessed May 1, 2021, <https://www.usace.army.mil/missions/civil-works/budget/>.
- ⁸ Descriptions of the demographic changes in the practice have not been linked causally to the current change in the agencies’ and professions’ integration of equity considerations, though media anecdotes suggest this. See Hannah Northey and Jeremy P. Jacobs, “Army Corps Pick Hailed as ‘Game Changer’ for Tribes,” *E&E News*, March 12, 2021, <https://www.eenews.net/greenwire/2021/03/12/stories/1063727235>.
- ⁹ The first and longest-standing P&G is the one from 1983, available at https://www.nrcs.usda.gov/wps/PA_NRCSCConsumption/download?cid=stelprdb1256524&ext=pdf. This version persisted until the 2014 Obama revisions. Pub. L. 89-80, amended 42 USC 1962a-2 and d-1.
- ¹⁰ National Environmental Policy Act of 1969, as amended, Pub. L. 91-190; 42 USC 4321, et seq.
- ¹¹ Pub. L. 91-611, 84 Stat. 1823.
- ¹² Memorandum for the Heads of Executive Departments and Agencies, 74 Fed. Reg. 5977, 5977–78 (Feb. 3, 2009).
- ¹³ For a review of Obama administration rules, see Sunstein (2013); “Circular A-4,” White House Office of Management and Budget, September 17, 2003, https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/; and “Updated Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies,” White House Council on Environmental Quality, accessed May 1, 2021, <https://obamawhitehouse.archives.gov/administration/eop/ceq/initiatives/PandG>.
- ¹⁴ See “Interagency Guidelines” on “Updated Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies,” White House Council on Environmental Quality, accessed May 1, 2021, <https://obamawhitehouse.archives.gov/administration/eop/ceq/initiatives/PandG>. See also *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, Final Interagency Guidelines*, 79 Fed. Reg. 247 (December 24, 2014).
- ¹⁵ “Circular No. A-94, Revised: Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs,” White House Office of Management and Budget, October 29, 1992, <https://georgewbush-whitehouse.archives.gov/omb/circulars/a094/a094.html>.

- ¹⁶ Rebecca Hersher and Robert Benincasa, “How Federal Disaster Money Favors the Rich,” *All Things Considered*, NPR, March 5, 2019, <https://www.npr.org/2019/03/05/688786177/how-federal-disaster-money-favors-the-rich>.
- ¹⁷ The USACE defines preferable flood resilience interventions to be ones that “prepare, absorb, recover, and adapt” shocks such as floodwaters.
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- ¹⁹ Robert Flowers (Lieutenant General, US Army Chief of Engineers), letter to the secretary of the Army, regarding Antelope Creek at Lincoln, Nebraska, December 29, 2000, <https://planning.erdc.dren.mil/toolbox/library/ChiefReports/Antelope%20Creek%2029%20Dec%2000.pdf>.
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- ²² “The Big U,” Rebuild by Design.
- ²³ “The Big U,” Rebuild by Design.
- ²⁴ “East Side Coastal Resiliency,” City of New York, accessed November 22, 2020, <https://www1.nyc.gov/site/escr/index.page>.
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